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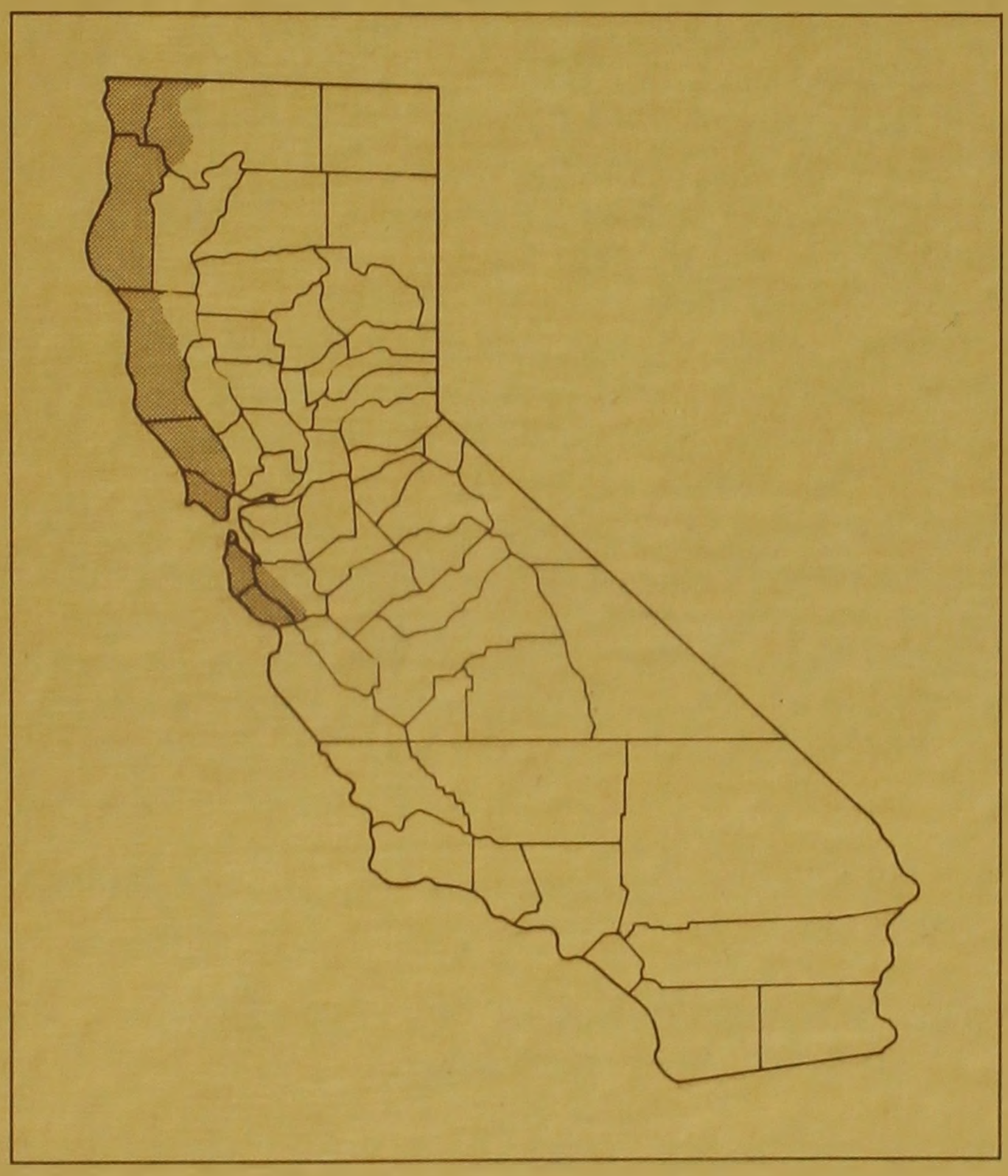
January 1953

# FOREST STATISTICS FOR THE REDWOOD - DOUGLAS-FIR SUBREGION IN CALIFORNIA



U. S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION

Stephen N. Wyckoff, Director

Berkeley, California

# FOREST STATISTICS FOR THE REDWOOD--DOUGLAS-FIR SUBREGION IN CALIFORNIA

By

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California Forest and Range Experiment Station

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The California Forest and Range Experiment Station
is maintained at Berkeley in cooperation with the
University of California

# FOREWORD

The Forest Survey, authorized by the McSweeney-McNary Act of 1928, is a nation-wide activity of the Forest Service designed to provide a comprehensive inventory of the forest resource of the United States. Responsibility for this Survey was assigned to the research branch of the Forest Service and its regional experiment stations. In California, the Forest Survey is a project of the Division of Forest Economics, California Forest and Range Experiment Station at Berkeley.

The five-fold objective of the Survey is: (1) To make an inventory of all forest land and the standing timber on that land; (2) To measure the current and probable future rate of timber growth, and the productive capacity of the forest land; (3) To determine the rate of timber depletion through cutting, fire, insects, disease, and other causes; (4) To determine the present and expected requirements for lumber and other forest products; and (5) To provide, through correlation of these facts with one another and with other economic knowledge, a basis for formulating local, State, and national forest policies and management plans.

The forest land of California has been subdivided into five subregions. These are the Redwood--Douglas-fir, the Coast Range Pine, the Westside Sierra Pine, the Eastside Sierra Pine, and the South Coast Range--Southern California units. Each subregion represents a different forest, geographic, and economic condition. This release presents statistics of forest areas, timber volumes, growth, drain, and ownership for the Redwood--Douglas-fir subregion, as of 1948. A similar report has been published for the Coast Range Pine subregion, and reports are planned for the remaining subregions of the State. In addition, county reports have been or are being prepared on the principal forest land counties of the Redwood--Douglas-fir subregion. These reports contain statistics on forest land area and ownership. Estimates of timber volume, growth, and drain are not included in the county reports because sampling was not designed to provide this information on areas as small as counties.

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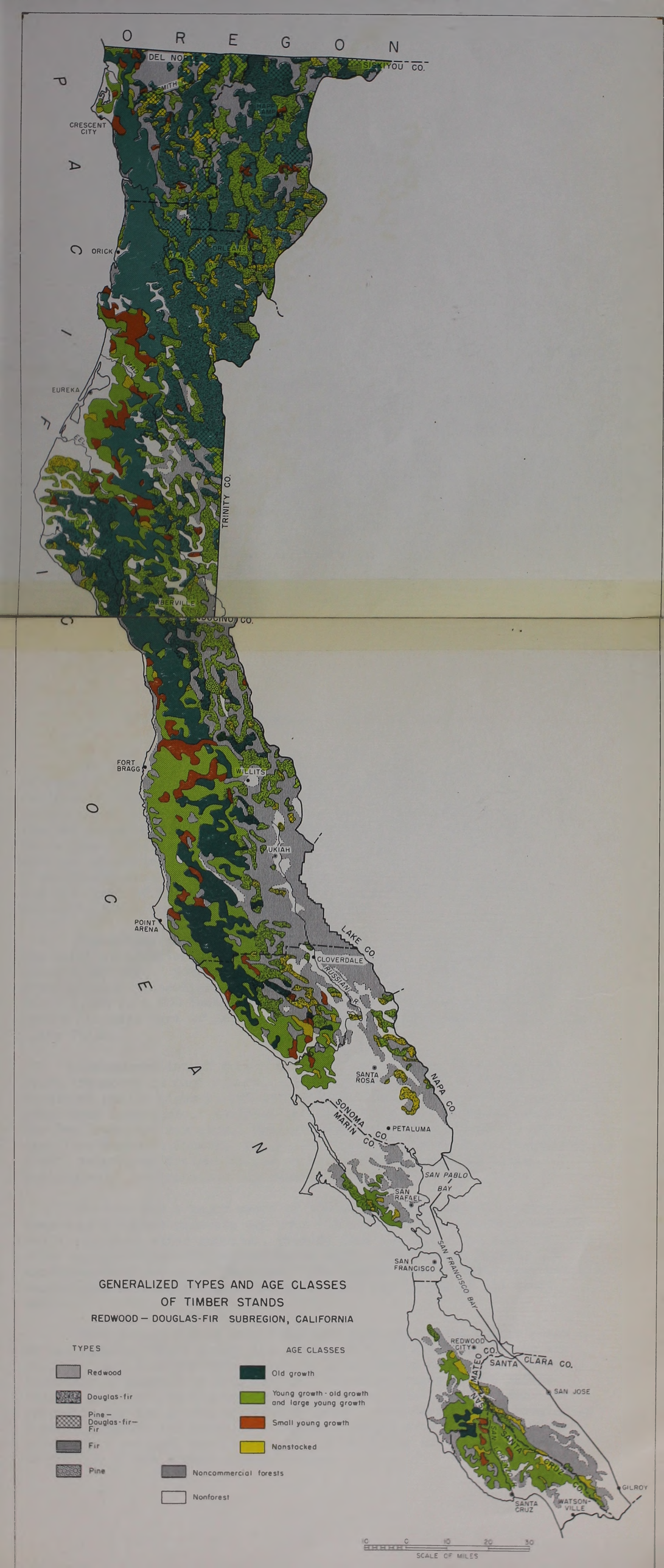

OREGON
DEL NORTE CO.
SISKIYOU CO.
SMITH
CRESCENT CITY
ORICK
HUMBOLDT CO.
EUREKA
TRINITY CO.
MENDOCINO CO.
FORT BRAGG
WILLITS
UKIAH
POINT ARENA
LAKE CO.
CLOVERDALE
RUSSIAN R.
SANTA ROSA
NAPA CO.
SONOMA CO.
MARIN CO.
PETALUMA
SAN PABLO BAY
SAN RAFAEL
SAN FRANCISCO
SAN FRANCISCO BAY
REDWOOD CITY
SAN MATEO CO.
SANTA CLARA CO.
SAN JOSE
SANTA CRUZ CO.
GILROY
SANTA CRUZ
WATSONVILLE
PACIFIC OCEAN
GENERALIZED TYPES AND AGE CLASSES OF TIMBER STANDS
REDWOOD — DOUGLAS-FIR SUBREGION, CALIFORNIA
TYPES
Redwood
Douglas-fir
Pine—Douglas-fir—Fir
Fir
Pine
AGE CLASSES
Old growth
Young growth - old growth and large young growth
Small young growth
Nonstocked
Noncommercial forests
Nonforest
10 0 10 20 30
SCALE OF MILES

# FACTS ABOUT THE REDWOOD--DOUGLAS-FIR SUBREGION

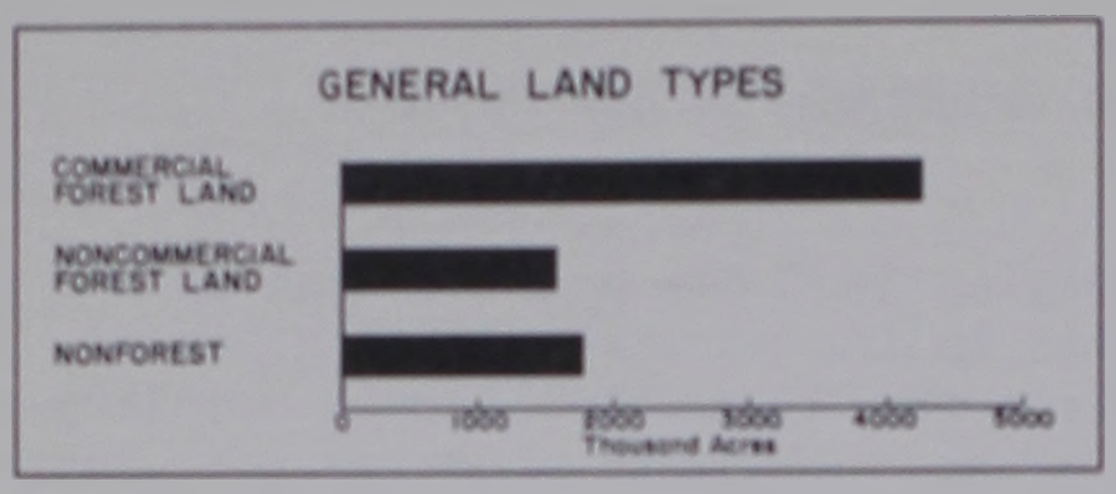
The Redwood--Douglas-fir subregion includes a total land area of about 7-1/2 million acres. Located in the northwestern portion of California, this subregion extends from the Oregon-California boundary in the north to Monterey Bay in the south. Complete counties included are Del Norte, Humboldt, Sonoma, Marin, San Francisco, San Mateo, and Santa Cruz. Siskiyou County west of the crests of the Marble and Siskiyou Mountains, Mendocino County west of the Eel River, and Santa Clara County west of a line approximately bisecting Santa Clara Valley are also part of the total area. All of these counties except Siskiyou and Santa Clara border on the Pacific Ocean.

Topography varies markedly throughout the length of the subregion. The northern counties are in general mountainous, with elevations to about 8,000 feet. South of Humboldt County the topography is predominantly hilly--interspersed with streams and valleys and spotted with peaks 2,000 to 4,000 feet elevation. In the extreme south, the subregion includes part of the broad level agricultural plain of the Santa Clara Valley.

Transportation of forest products is by truck, rail, and ship. Truck transport is most common. All counties have at least one well developed public highway, but timber access road development is generally considered inadequate. Railroad facilities are most extensive around the San Francisco Bay area. One railroad operates north of the Bay area into Humboldt County. Del Norte County has no railroad transportation. Waterborne freight shipments are handled at several ports, particularly San Francisco Bay, Humboldt Bay, and Crescent City.

Forests are a major asset of the Redwood--Douglas-fir subregion. They supply forest products and jobs for mill and woods workers and also are a source of water supplies, provide food and cover for wildlife, and offer opportunities for recreation as well. The redwood forests are world-renowned scenic attractions. The tourist trade, which they attract, contributes substantially to the employment and income of the local people.

This Forest Survey unit comprises essentially the entire range of the redwood, which grows in a narrow 10 to 30 mile strip along the Pacific Coast from Monterey County to southwestern Oregon. A common associate of redwood is Douglas-fir. The main stands of the latter species grow east of the coastal strip, under climatic conditions unfavorable for the growth of redwood trees. Considering the subregion as a whole, Douglas-fir actually occupies a larger area and has a greater volume than redwood, and Douglas-fir is providing an increasingly larger proportion of the timber product output.

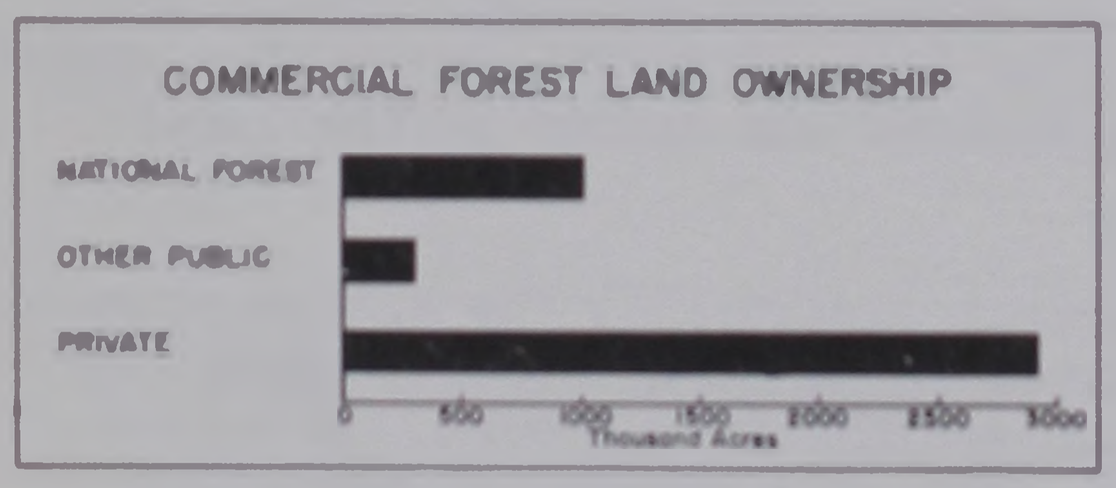



Forest Area. Forest land comprises more than three-fourths--5.8 million acres--of the total land area in this subregion. (table 1).

About one-fourth of the forest land is classified as noncommercial.1/ (tables 1 and 3). Eighty-eight percent of the noncommercial land, almost 1.4 million acres, is incapable of producing timber of commercial quantity and quality because of poor site conditions. Most of this area is occupied by a mixed cover of hardwoods and grass valuable for forage production and dense stands of chaparral primarily valuable for watershed protection and wildlife maintenance. The remaining 186 thousand acres of noncommercial forest land is timber producing land withdrawn from timber utilization as redwood parks and wilderness area.

Commercial forest land, now growing or capable of growing usable crops of wood, composes 73 percent of the forest land, or 4.2 million acres. The remaining discussion deals with this commercial forest land.

Two-thirds of the subregion's commercial forest land is located within two counties. Humboldt County contains 41 percent and Mendocino County 25 percent (table 2). About three-fourths of the total land area of Humboldt County is classified as commercial forest land. In Mendocino County, the commercial forest land comprises about 60 percent of the total land area. Much of the State's lumber production is from these two counties. In 1948, Humboldt County produced more lumber than any other county. Mendocino County was second. Together they produced about 30 percent of the State lumber production for that year.




Ownership. About two out of every three acres of commercial forest land are privately owned (table 4). Half of this 2.9 million acres of private land is owned by corporations or persons who are engaged in commercial logging and milling of timber or who are holding land for such operations in the future. Lumber operating corporations own most of this forest land. Farmers own 36 percent of the privately owned commercial forest land--primarily

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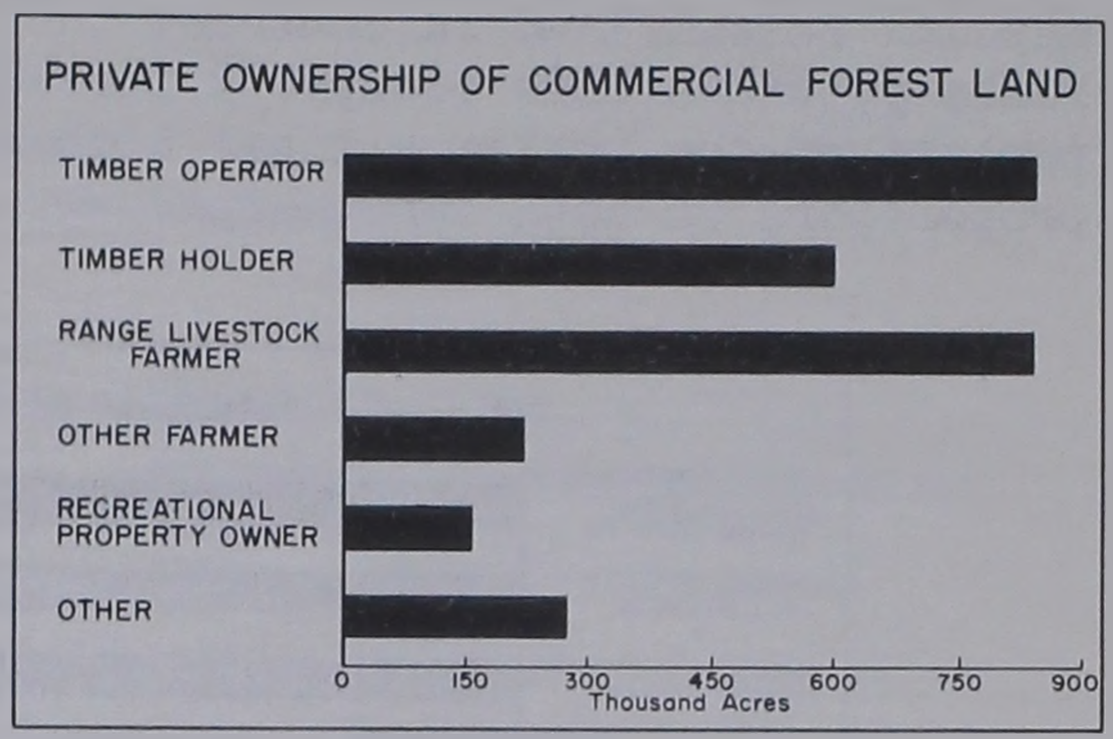
1/ For explanation of terms used in this report see section entitled "Definition of Terms," page 47.

as individually owned range livestock farms. The remainder is in recreation, residential, mining, and reservoir sites. Fifty-seven percent of the privately owned commercial forest land is in holdings of less than 5,000 acres (table 5). This land is divided among 9,706 different ownerships. Fifteen percent of the privately owned land is in holdings of 50,000 acres and larger. These large holdings (primarily in redwood) include only five ownerships.2/




Publicly owned commercial forest land totals 1.3 million acres. More than 90 percent of this, or 1.2 million acres, is in Federal ownership. Most of the Federal land is in national forests, primarily the Six Rivers and Klamath National Forests. Other Federal ownerships include Indian land and public domain (201,000 acres). The remainder of the publicly owned commercial forest land is in State, county, and municipal holdings.

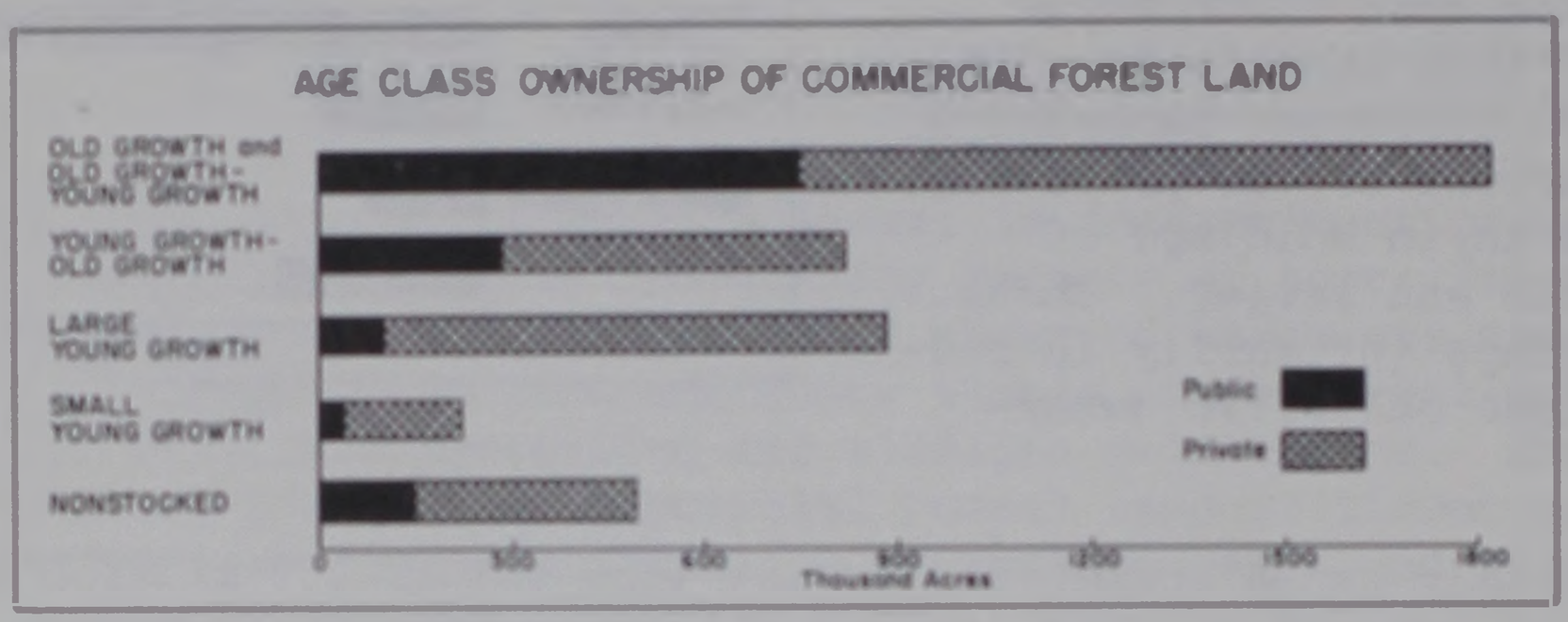
Timber Stand Classes. Although logging operations have been under way in the subregion for a little over 100 years, 43 percent (1.8 million acres) of the commercial forest land remains stocked with stands composed predominantly of mature timber--the old-growth and old growth-young growth age classes (table 4). This uneven-aged condition is characteristic of the uncut stands in the subregion. An additional 19 percent (819 thousand acres) is occupied by timber stands in the young growth-old growth age class, that is, stands of mixed age classes in which the young timber predominates.

Old cut-over and burned areas stocked with second-growth stands of saw-timber size (large young growth) occupy 21 percent of the commercial forest land, or 883 thousand acres. Recent cut-over and burned areas with conifer stands of less than saw-timber size occupy 17 percent, or 715 thousand acres. One-third of the recent cut-over and burned area is sufficiently stocked with young conifer trees to be classified as small young growth. The remaining two-thirds (493 thousand acres) is covered primarily with hardwoods and chaparral with little or no conifer reproduction. Because only conifers are considered in determining the stocking classification, these areas are classified as nonstocked.

Through the long history of lumbering in this subregion, timber operations have been predominantly on private forest holdings. These operations were in not only the better, but also the most accessible stands. The proportions of old-growth and young-growth timber areas in private and public ownership (table 4) show this difference in rate of

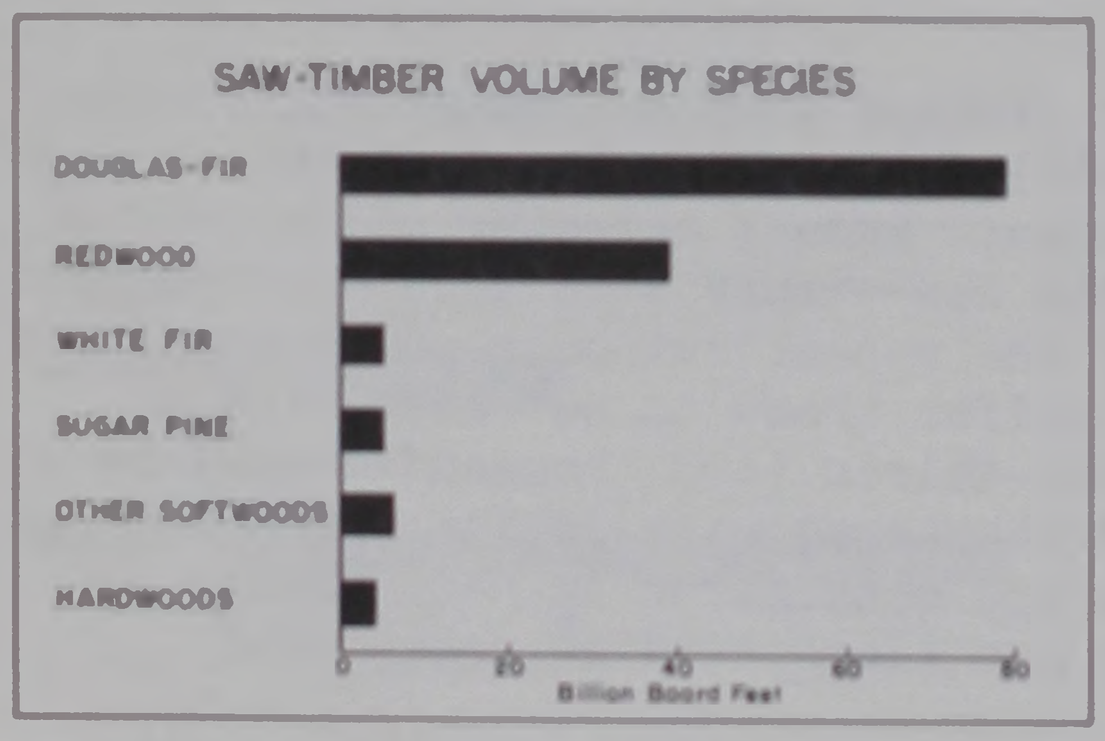
2/ A more detailed report on forest land ownership will be published separately.

use. Old-growth stands occupy 37 percent of the privately owned commercial forest land in contrast to 57 percent of the publicly owned. Young-growth stands occupy 33 percent of the private land and only 10 percent of the public. Other timber stand classes occur about in equal proportions in both ownerships.




Two forest types comprise better than 90 percent of the subregion commercial forest land. These are the Douglas-fir type (47 percent) and the redwood type[3/] (45 percent). Ninety-three percent of the redwood type is in private ownership--primarily in larger holdings. Slightly more than half the Douglas-fir type is privately owned (table 6). Most of the remaining commercial forest land is occupied by mixed stands of ponderosa and sugar pines, Douglas-fir, and true firs.

Site Quality. Almost two-thirds of the commercial forest land is highly productive for timber growing. In contrast, only 7 percent is classified as poor for growing trees (table 9). About 80 percent of the redwood type area is rated high in productive capacity, and about 50 percent of the Douglas-fir type.




Timber Volume. In 1948, the forests of the Redwood--Douglas-fir subregion contained a standing net saw-timber volume of 137.6 billion board feet by the International 1/4-inch log rule; 130.5 billion by the Scribner rule[4/] (table 10). This estimate includes the volume of all sound conifer and hardwood trees, 11.0 inches or more in diameter, after deduction of cull

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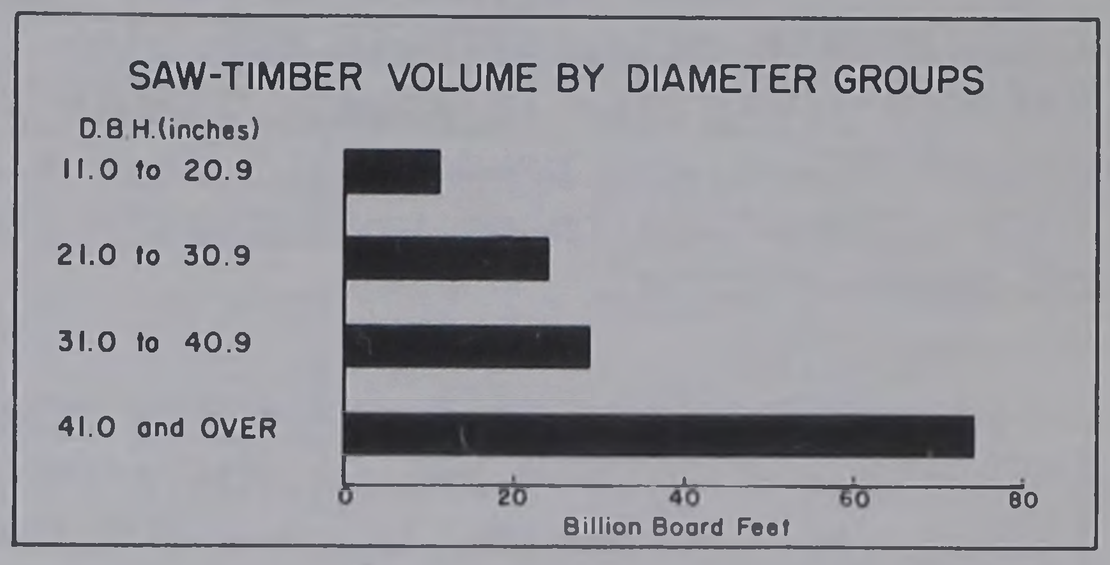
3/ Mixed stands of redwood and Douglas-fir are typed as redwood when this species comprises 20 percent or more of the conifer cover.

4/ Most private operators in this subregion measure timber volume by the Spaulding log rule. Estimates thus obtained closely approximate volumes in Scribner scale.

and felling breakage from gross volume. Ninety-seven percent of the total volume is in softwoods, chiefly Douglas-fir and redwood. Douglas-fir alone makes up 57 percent of the total volume, redwood 28 percent. White fir and sugar pine compose most of the remaining softwood volume. Of the hardwoods, tanoak has the largest volume.

Fifty-four percent of the net board-foot volume (all species) in this survey unit is made up of trees 41.0 inches and larger in diameter (table 10). Of the redwood volume, 71 percent is in this largest diameter group. The comparable figure for Douglas-fir is 52 percent. Only 8 percent of the total volume (all species) is in the smallest diameter group, 11.0 to 20.9 inches.




Almost two-thirds of the net saw-timber volume is in old growth and old growth-young growth stands (table 11), that is, stands in which mature and overmature trees are predominant. These stands contain a large volume in mature timber, which is ready for harvesting for lumber, plywood, and other high-quality timber products. Much of this volume is still in inaccessible timber stands. Development of a system of access roads will permit utilization of a large volume of this timber that would otherwise be lost through fire, insects, disease, or windthrow. To sustain the subregion timber industry, cutting programs must provide for restocking cut-over areas and for spreading operations in old-growth timber over the period necessary to develop merchantable stands of second-growth timber.

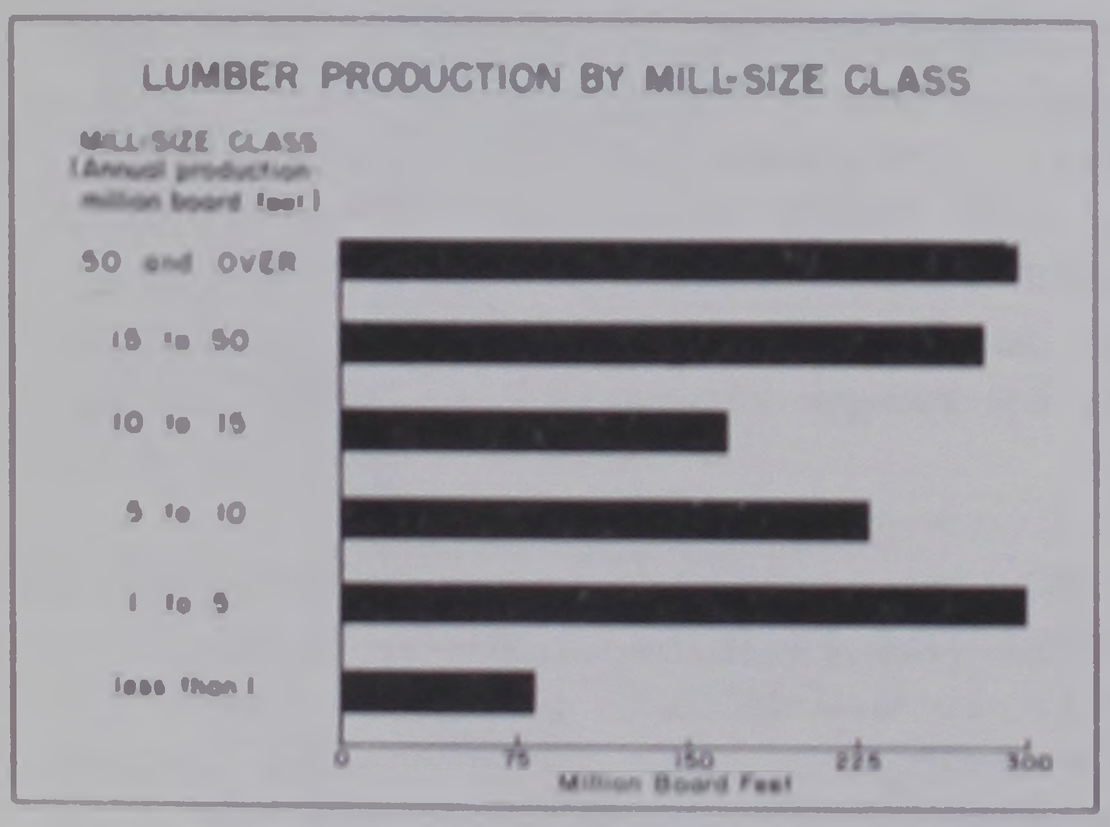
More than two-thirds of the subregion saw-timber volume (95 billion board feet) is on privately owned commercial forest land (table 12). Thirty-seven percent of this is owned by corporations and individuals engaged in commercial logging and milling of timber. Most of this volume is in old-growth stands. Corporations and individuals holding timber for future operations, and range livestock farmers, each own about 25 percent of the private saw-timber volume. Seventy-five percent of the volume owned by timber holders is in old-growth stands, while about 60 percent of volume held by range livestock farmers is in predominantly young-growth stands.

The publicly owned saw-timber volume (42.5 billion board feet) is concentrated in federal ownership. National forests contain about three-fourths of this volume, primarily in old-growth stands. Much of this volume is relatively inaccessible owing to lack of adequate timber access roads. Two-thirds of the remainder is in Indian and public domain commercial forest land, and one-third in State, county, and municipal ownership.

Growth. Average annual growth for the Redwood--Douglas-fir subregion--after deducting mortality--is 1.1 billion board feet (table 17). This is an average annual net growth per acre of 251 board feet for the decade 1939-1948. Average annual per acre mortality for the same period is 124 board feet. Better than half of the total net growth is in stands classified as large young growth. These stands show an average annual net growth per acre of 670 board feet, actually reaching better than 1,000 board feet in some of the heaviest stands. This high growth rate reflects the high timber-growing potential of the Redwood--Douglas-fir area. Timber stands in which mature and overmature trees are predominant show a net growth of 130 board feet per acre. Immature trees undoubtedly contribute much to total net growth of these stands.

Commodity Drain. Average annual commodity drain from the forest resource during the period 1947-1949 was 1.7 billion board feet (table 31). Of this, 1.3 billion board feet was removed from the saw-timber growing stock as sawlogs and other products. In addition to the usable products removed, a substantial volume of saw-timber was destroyed or left in the woods as rough or short logs, butt logs, and merchantable tops. This logging waste amounted to about 400 million board feet, exclusive of cull and breakage. Much of this material cannot be used by existing mills because of small size, poor quality, or lack of concentration. It could, however, provide a source of raw material for supplementary mills located closer to the timber areas and for fibre-using plants.

In 1948, about 90 percent of the logs cut in this subregion went into lumber production. This amounted to slightly less than 1.4 billion board feet or 34 percent of the State's total lumber production for that year. The leading lumber-producing species was redwood, followed closely by Douglas-fir (table 21). Lumber production has increased sharply since 1948, reaching about 2 billion board feet in 1951, and Douglas-fir has replaced redwood as the leading lumber species.




Three hundred and ninety-three sawmills were active in the subregion in 1948 (table 22). The five large mills, that is, mills with annual outputs of 50 million board feet or more, produced 22 percent of the total lumber production. In contrast, the 217 small mills, with outputs of less than a million board feet annually, produced only 6 percent of the total.

Other sawmills, located outside the subregion, also drew on the timber resource of this subregion for a supply of sawlogs and veneer logs. These exports were equal to about 1 percent of the subregion 1948 lumber production.

In addition to lumber production, a substantial demand was made on the forests by producers of veneer and plywood, cooperage, pulpwood, shingles, shakes, piling, ties, and posts and other split products. For the most part these products require a special kind and quality of material. Veneer production in particular requires logs of the largest sizes and highest quality.

Net Growth vs Commodity Drain. In 1948, 39 percent (about 700 million board feet) more timber was removed from the saw-timber inventory volume as timber products and logging waste than was added by growth. A deficit of growth in relation to commodity drain is to be expected in this subregion where two-thirds of the saw-timber volume is in uncut old-growth stands. Drain may be expected to exceed growth even further for the next few years because of expanded cutting of Douglas-fir timber. Old-growth stands generally have high mortality losses and consequently show only little net growth. The rate of growth should increase, provided a good stocking of residual saw-timber growing stock is left following cutting and the areas are adequately protected. Successful regeneration and good forest management will also be necessary to sustain the timber industry in this area.

## Comparison with 1945 report

An evaluation of the forest resource in California was made in 1945 as part of a national reappraisal of the forest situation. In California, this inventory was a combined undertaking of the Forest Service, the State Division of Forestry, and the American Forestry Association. Although the study was statewide in nature, some data on forest areas and timber volumes were collected and presented by subregions. The results for California were published in Forest Survey Release No. 4, entitled "Forest Areas, Timber Volumes, and Vegetation Types in California."

Forest area and timber volume estimates as published for the Douglas-fir and Redwood units in 1945 were combined for comparison with similar estimates for the Redwood--Douglas-fir subregion of Forest Survey. The results show notable differences, some attributable to boundary changes, some to changes in timber specifications, and some to use of better survey techniques.

Commercial forest land as estimated in 1948 is 67 thousand acres less than the estimate for 1945. This 2 percent difference is the net effect of two changes. One is a reduction in commercial forest land resulting from exclusion of part of the Douglas-fir unit of 1945 from the Redwood--Douglas-fir subregion of 1948. The other change is an increase in commercial forest land resulting from a more detailed aerial-photo classification in 1948. These changes have been more or less compensating.

Saw-timber volume on commercial forest land, appraised at 86.1 billion board feet in 1945, was estimated to be 130.5 billion board feet (Scribner log rule) by the Forest Survey in 1948. This increase

in volume estimates is the consequence of a number of factors. Important among these is the higher deduction in 1945 for cull and breakage in Douglas-fir--the major species by volume. Specifically, this difference in cull and breakage deductions accounts for about 20 percent of the change in inventory volume estimates. Then too, there is a difference in species included. The 1945 estimate included only volumes of commercial conifer species, while the 1948 inventory included all conifer and hardwood species found on the commercial forest land. This species difference amounts to about 10 percent of the change in volume estimates. Also, the board foot volume in the redwood type in 1945 included only those trees 24.0 inches d.b.h. and larger, while the 1948 data included all trees larger than 11.0 inches. This difference in minimum diameter limit accounts for about 5 percent of the change in volume estimates between inventories.

The major factor contributing to the change in inventory volumes, however, is the difference in the method of determining timber volume. The 1945 volume estimate was based on data of varying reliability from many different sources. This information was most accurate for the redwood type and weakest for the Douglas-fir and fir types. Undoubtedly the merchantable volume of Douglas-fir was underestimated in 1945 because "white woods" were formerly considered of little value in the redwood area. The 1948 Forest Survey estimate is based on measurements of timber on field plots that were selected to provide a statistically sound estimate of timber in all parts of the subregion.

Table 1.- Total land area by cover type and use, 1948

| Cover type and use | Area<br>Thousand acres |
|---|---|
| Commercial forest land | |
| Douglas-fir | 2,005 |
| Redwood | 1,918 |
| Pine--Douglas-fir--Fir | 266 |
| Fir | 39 |
| Pine | 10 |
| Total commercial | 4,238 |
| Noncommercial forest land | |
| Reserved from commercial timber use | |
| Douglas-fir | 66 |
| Redwood | 53 |
| Pine--Douglas-fir--Fir | 43 |
| Fir | 24 |
| Pine | - |
| Total | 186 |
| Unproductive for timber use1/ | |
| Coniferous woodland | 242 |
| Hardwoods (woodland) | 226 |
| Woodland grass | 557 |
| Chaparral | 357 |
| Total | 1,382 |
| Total noncommercial | 1,568 |
| Total forest land | 5,806 |
| Nonforest land | |
| Coastal sagebrush | 45 |
| Grass | 889 |
| Barren | 44 |
| Marsh | 35 |
| Cultivated, urban and industrial | 736 |
| Water2/ | 23 |
| Total nonforest land | 1,772 |
| All land | 7,578 |

1/ Includes 28,000 acres withdrawn principally for recreational purposes as a wilderness area.

2/ Water according to survey standards of area classification but defined by the Bureau of Census as land.

Table 2.- County area by major land class, 1948

| County | Total land area in county 1/ | Redwood--Douglas-fir subregion | | | | |
|---|---|---|---|---|---|---|
| | | Total land area | Forest land | | | Non-forest land |
| | | | Total | Commercial | Non-commercial | |
| | Thousand acres | | | | | |
| Del Norte | 642 | 642 | 615 | 451 | 164 | 27 |
| Humboldt | 2,287 | 2,287 | 1,946 | 1,740 | 206 | 341 |
| Marin | 333 | 333 | 119 | 31 | 88 | 214 |
| Mendocino | 2,246 | 1,675 | 1,437 | 1,064 | 373 | 238 |
| San Francisco | 29 | 29 | (2/) | - | (2/) | 29 |
| San Mateo | 291 | 291 | 127 | 59 | 68 | 164 |
| Santa Clara | 835 | 324 | 121 | 24 | 97 | 203 |
| Santa Cruz | 281 | 281 | 190 | 125 | 65 | 91 |
| Siskiyou | 4,040 | 705 | 698 | 448 | 250 | 7 |
| Sonoma | 1,011 | 1,011 | 553 | 296 | 257 | 458 |
| Total all counties | 11,995 | 7,578 | 5,806 | 4,238 | 1,568 | 1,772 |

1/ From "Areas of the United States 1940," U. S. Bureau of the Census.

2/ Less than 500 acres.

Table 3.- Total land area by major classes of land and by ownership class, 1948

| Class of land | Total all ownerships | Federally owned or managed 1/ | | | | State | County and municipal | Private | Unclassified 3/ |
|---|---|---|---|---|---|---|---|---|---|
| | | Total federal | National forest | Indian | Other 2/ | | | | |
| | Thousand acres | | | | | | | | |
| Forest land | | | | | | | | | |
| Commercial | 4,238 | 1,207 | 1,006 | 103 | 98 | 102 | 7 | 2,922 | - |
| Noncommercial | | | | | | | | | |
| Reserved from commercial timber use 4/ | 186 | 132 | 132 | - | - | 52 | 2 | - | - |
| Unproductive for timber use 5/ | 1,382 | 375 | 280 | 2 | 93 | 14 | 17 | 929 | 47 |
| Total forest land | 5,806 | 1,714 | 1,418 | 105 | 191 | 168 | 26 | 3,851 | 47 |
| Nonforest land | 6/ 1,772 | 27 | 11 | 8 | 8 | 11 | 13 | 1,238 | 483 |
| All land | 7,578 | 1,741 | 1,429 | 113 | 199 | 179 | 39 | 5,089 | 530 |

1/ Because all figures in this tabulation are derived by sampling procedure, total acreage figures vary slightly from actual published land acreages of various public agencies listed here.

2/ Chiefly public domain.

3/ This area includes the urban, industrial, agricultural, and otherwise intensively developed land located outside the broad limits of the commercial forest land but within the Redwood--Douglas-fir subregion boundary. Ownership aspects of this area were not considered essential to this study.

4/ The estimated net volume of timber on this area is 7.1 billion board feet (Int. 1/4-inch log rule).

5/ Includes 28,000 acres withdrawn for special use.

6/ Includes 23,000 acres of water according to survey standards of area classification but defined by the Bureau of Census as land.

Table 4.- Commercial forest land by type of ownership and by age class of timber, 1948

| Type of ownership | All age classes | | Age class 1/ | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| | Thousand acres | Pct. | ---------- Thousand acres ---------- | | | | | |
| National forest | 1,006 | 23.8 | 33 | 545 | 237 | 50 | 30 | 111 |
| Indian land | 103 | 2.4 | 7 | 72 | 5 | 4 | 2 | 13 |
| Other Federal | 98 | 2.3 | 8 | 39 | 21 | 11 | 2 | 17 |
| State forest | 48 | 1.1 | (2/) | 7 | 9 | 26 | 4 | 2 |
| Tax deeded | 49 | 1.2 | 1 | 27 | 11 | 6 | 1 | 3 |
| Other State | 5 | 0.1 | 2 | 1 | 2 | (2/) | - | (2/) |
| County and municipal | 7 | 0.2 | (2/) | 2 | 1 | 2 | (2/) | 2 |
| Total Public | 1,316 | 31.1 | 51 | 693 | 286 | 99 | 39 | 148 |
| Timber operating company | 735 | 17.3 | 128 | 254 | 96 | 122 | 87 | 48 |
| Timber holding company | 171 | 4.0 | 14 | 80 | 25 | 39 | 4 | 9 |
| Timber operating individual | 106 | 2.5 | 9 | 47 | 26 | 13 | 2 | 9 |
| Timber holding individual | 426 | 10.1 | 54 | 190 | 59 | 77 | 23 | 23 |
| Range livestock farming company | 56 | 1.3 | 2 | 6 | 18 | 24 | 2 | 4 |
| Range livestock farming individual | 782 | 18.5 | 19 | 168 | 201 | 259 | 26 | 109 |
| Other farmers | 219 | 5.2 | 4 | 31 | 30 | 84 | 10 | 60 |
| Recreational property owners | 155 | 3.7 | 3 | 30 | 37 | 51 | 8 | 26 |
| Other classified owners 3/ | 245 | 5.7 | 1 | 36 | 40 | 98 | 19 | 51 |
| Unclassified 4/ | 27 | 0.6 | (2/) | 1 | 1 | 17 | 2 | 6 |
| Total Private | 2,922 | 68.9 | 234 | 843 | 533 | 784 | 183 | 345 |
| All ownerships | 4,238 | 100.0 | 285 | 1,536 | 819 | 883 | 222 | 493 |
| Percent | | 100.0 | 6.7 | 36.3 | 19.3 | 20.8 | 5.2 | 11.7 |

1/ Timber stands on commercial forest land were classified into age classes on the basis of commercial conifers present. Hardwoods were not considered.

2/ Less than 500 acres.

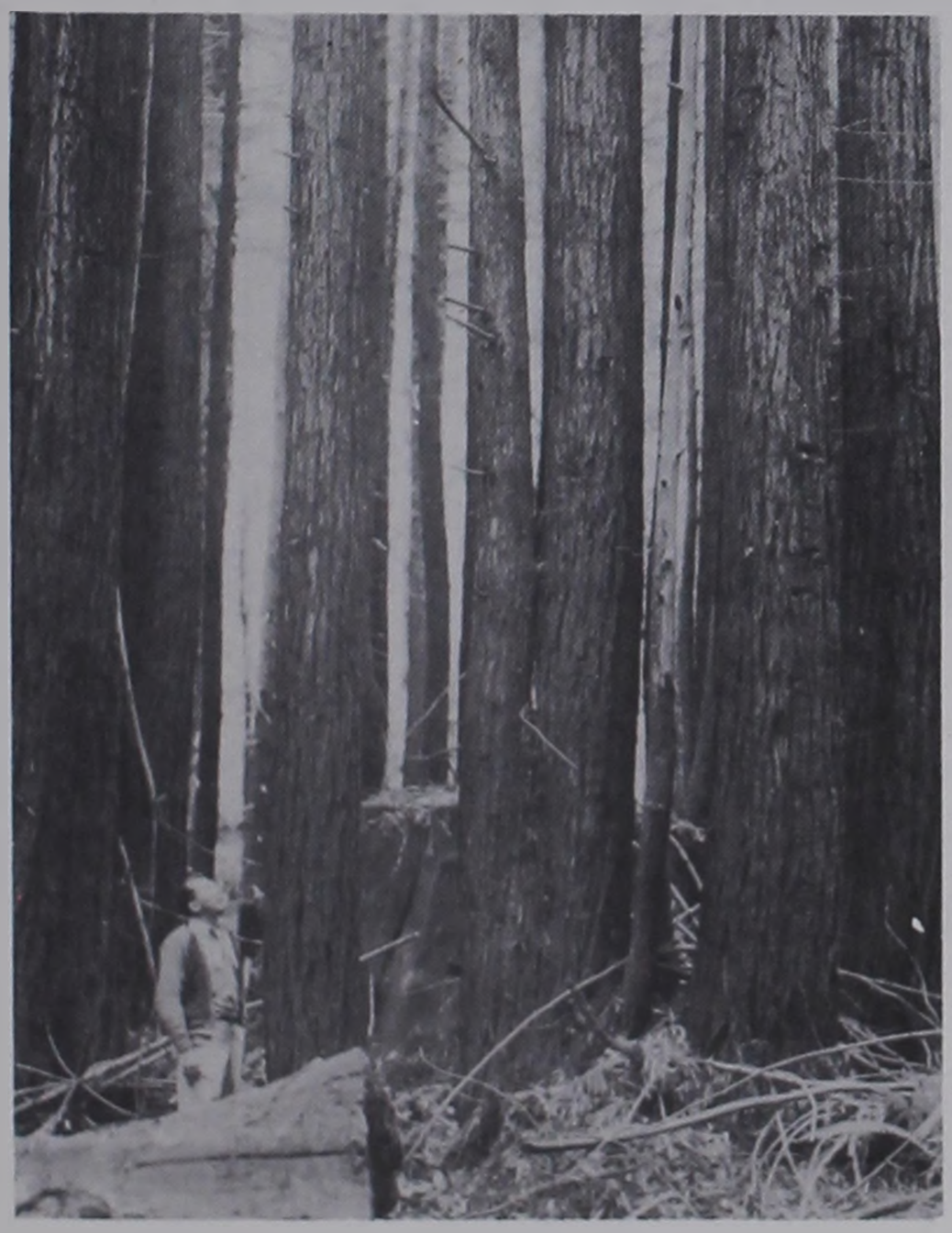
3/ All other owners whose classification is known but does not logically fit the classes listed above. Examples are owners of land held for residential purposes only, mining claims, and reservoir sites.

4/ Small urban, suburban and industrial ownerships that are too small to map and classify properly, and ownerships that for other reasons cannot be classified and placed in appropriate categories.

# AGE CLASSES OF TIMBER STANDS ON COMMERCIAL FOREST LAND

Old growth

Young growth - old growth



Large young growth

Small young growth

Table 5.- Privately owned commercial forest land by size of ownership, number of owners, and age class of timber, 1948

| Size of ownership 1/ | Ownerships 2/ | | Commercial forest land | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | All age classes | | Age class | | | | | | | |
| | | | | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| Acres | No. | Pct. | Thousand acres | Pct. | ---------- Thousand acres ---------- | | | | | |
| 1- 179 | 7,614 | 77.5 | 409 | 14.1 | 17 | 106 | 72 | 136 | 17 | 61 |
| 180- 379 | 935 | 9.5 | 206 | 7.1 | 6 | 56 | 43 | 53 | 8 | 40 |
| 380- 699 | 486 | 4.9 | 228 | 7.9 | 8 | 62 | 40 | 73 | 7 | 38 |
| 700- 1,299 | 303 | 3.1 | 216 | 7.5 | 6 | 53 | 51 | 60 | 12 | 34 |
| 1,300- 2,599 | 242 | 2.5 | 308 | 10.6 | 26 | 94 | 53 | 80 | 10 | 45 |
| 2,600- 4,999 | 126 | 1.3 | 295 | 10.2 | 22 | 72 | 66 | 87 | 15 | 33 |
| 5,000- 9,999 | 62 | 0.6 | 243 | 8.4 | 17 | 54 | 50 | 79 | 14 | 29 |
| 10,000-19,999 | 34 | 0.3 | 346 | 12.0 | 36 | 109 | 68 | 94 | 17 | 22 |
| 20,000-29,999 | 5 | 0.1 | 77 | 2.7 | 18 | 30 | 7 | 13 | 5 | 4 |
| 30,000-49,999 | 5 | 0.1 | 137 | 4.7 | 23 | 76 | 16 | 10 | 5 | 7 |
| 50,000 and over | 5 | 0.1 | 428 | 14.8 | 55 | 130 | 65 | 81 | 71 | 26 |
| All classified ownerships | 9,817 | 100.0 | 2,893 | 100.0 | 234 | 842 | 531 | 766 | 181 | 339 |
| Unclassified | - | - | 29 | - | (3/) | 1 | 2 | 18 | 2 | 6 |
| Total acreage | - | - | 2,922 | - | 234 | 843 | 533 | 784 | 183 | 345 |

1/ Size classification is based on total land owned.
2/ These figures represent only the owners having commercial forest land in their holdings.
3/ Less than 500 acres.

Table 6.- Commercial forest land by type of ownership and by timber type, 1948

| Type of ownership | All types | | Timber type | | | | |
|---|---|---|---|---|---|---|---|
| | | | Douglas-fir | Redwood | Pine--Douglas-fir--Fir | Fir | Pine |
| | Thousand acres | Pct. | ---------- Thousand acres ---------- | | | | |
| National forest | 1,006 | 23.8 | 740 | 5 | 222 | 36 | 3 |
| Other Federal | 201 | 4.7 | 164 | 36 | 1 | - | - |
| State, County and municipal | 109 | 2.6 | 20 | 87 | 1 | 1 | - |
| Total Public | 1,316 | 31.1 | 924 | 128 | 224 | 37 | 3 |
| Timber operating company and individual | 841 | 19.8 | 98 | 734 | 8 | - | 1 |
| Timber holding company and individual | 597 | 14.1 | 190 | 389 | 16 | 2 | - |
| Range livestock farming company and individual | 838 | 19.8 | 521 | 300 | 13 | - | 4 |
| Other farmers | 219 | 5.2 | 97 | 120 | 1 | - | 1 |
| Other classified owners1/ | 400 | 9.4 | 168 | 227 | 4 | - | 1 |
| Unclassified | 27 | 0.6 | 7 | 20 | - | - | - |
| Total Private | 2,922 | 68.9 | 1,081 | 1,790 | 42 | 2 | 7 |
| All Ownerships | 4,238 | 100.0 | 2,005 | 1,918 | 266 | 39 | 10 |
| Percent | 100.0 | | 47.3 | 45.3 | 6.3 | 0.9 | 0.2 |

1/ Includes recreational property owners as well as property owners not logically fitting the classes listed.

Table 7.- Commercial forest land by timber type and by age class of timber, 1948

| Timber type | All age classes | Age class | | | | | |
|---|---|---|---|---|---|---|---|
| | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| | Thousand acres | | | | | | |
| Douglas-fir | 2,005 | 71 | 863 | 441 | 302 | 47 | 281 |
| Redwood | 1,918 | 204 | 523 | 295 | 563 | 164 | 169 |
| Pine--Douglas-fir--Fir | 266 | 9 | 131 | 67 | 14 | 8 | 37 |
| Fir | 39 | 1 | 16 | 12 | 1 | 3 | 6 |
| Pine | 10 | - | 3 | 4 | 3 | - | (1/) |
| All types | 4,238 | 285 | 1,536 | 819 | 883 | 222 | 493 |

1/ Less than 500 acres.

Table 8.- Commercial forest land by age class of timber and by density of stand, 1948

| Age class | All densities | Density of stand 1/ | | | |
|---|---|---|---|---|---|
| | | Dense and semi-dense | Open | Very open | Nonstocked |
| | Thousand acres | | | | |
| Old growth | 285 | 259 | 13 | 13 | - |
| Old growth-young growth | 1,536 | 1,001 | 413 | 122 | - |
| Young growth-old growth | 819 | 403 | 290 | 126 | - |
| Large young growth | 883 | 439 | 279 | 165 | - |
| Small young growth | 222 | 39 | 62 | 121 | - |
| Nonstocked | 493 | - | - | - | 493 |
| Total | 4,238 | 2,141 | 1,057 | 547 | 493 |
| Percent | 100.0 | 50.5 | 25.0 | 12.9 | 11.6 |

1/ Survey density classes of timber stands on commercial forest land were based on commercial conifers only. Hardwoods were not considered.

Table 9.- Commercial forest land by timber type and by site quality, 1948

| Timber type | Total | Site quality1/ | | |
|---|---|---|---|---|
| | | High | Medium | Low |
| | ---------- Thousand acres ---------- | | | |
| Douglas-fir | 2,005 | 1,063 | 732 | 210 |
| Redwood | 1,918 | 1,559 | 328 | 31 |
| Other2/ | 315 | 126 | 128 | 61 |
| All types | 4,238 | 2,748 | 1,188 | 302 |
| Percent | 100.0 | 64.9 | 28.0 | 7.1 |

1/ For relationship between broad site quality classes and site class and site index, see page 44.

2/ Includes the following types and type acreages: Pine--Douglas-fir--Fir, 266,000 acres; Fir, 39,000 acres; Pine, 10,000 acres.

Table 10.- Net volume of live saw timber on commercial forest land by species and by diameter class groups, 1948

| Species | Total | | Diameter class groups | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 11.0 - 20.9" d.b.h. | | 21.0 - 30.9" d.b.h. | | 31.0 - 40.9" d.b.h. | | 41.0" and larger d.b.h. | |
| | Million board feet | | | | | | | | | |
| | Int.[1] | Scrib.[2] | Int. | Scrib. | Int. | Scrib. | Int. | Scrib. | Int. | Scrib. |
| Softwoods | | | | | | | | | | |
| Douglas-fir | 78,968 | 74,931 | 4,475 | 3,971 | 13,777 | 12,777 | 19,628 | 18,598 | 41,088 | 39,585 |
| Redwood | 38,778 | 36,871 | 2,840 | 2,532 | 4,045 | 3,703 | 4,469 | 4,180 | 27,424 | 26,456 |
| White fir | 5,030 | 4,686 | 835 | 738 | 1,814 | 1,678 | 1,431 | 1,358 | 950 | 912 |
| Sugar pine | 4,694 | 4,450 | 187 | 166 | 898 | 834 | 1,251 | 1,185 | 2,358 | 2,265 |
| Ponderosa and Jeffrey pines | 2,582 | 2,430 | 194 | 173 | 837 | 777 | 975 | 925 | 576 | 555 |
| Grand fir | 1,291 | 1,209 | 211 | 186 | 365 | 337 | 213 | 202 | 502 | 484 |
| California red fir | 712 | 667 | 59 | 53 | 307 | 284 | 225 | 214 | 121 | 116 |
| Incense cedar | 591 | 560 | 39 | 34 | 146 | 136 | 161 | 154 | 245 | 236 |
| Western hemlock | 536 | 500 | 97 | 86 | 131 | 121 | 154 | 145 | 154 | 148 |
| Other | [3] 829 | 756 | 422 | 370 | 196 | 182 | 16 | 15 | 195 | 189 |
| Total softwoods | 134,011 | 127,060 | 9,359 | 8,309 | 22,516 | 20,829 | 28,523 | 26,976 | 73,613 | 70,946 |
| Hardwoods | | | | | | | | | | |
| Tanoak | 1,967 | 1,937 | 829 | 810 | 736 | 728 | 315 | 313 | 87 | 86 |
| Madrone | 852 | 839 | 429 | 421 | 279 | 276 | 132 | 130 | 12 | 12 |
| Other | [4] 723 | 709 | 342 | 334 | 307 | 302 | 74 | 73 | - | - |
| Total hardwoods | 3,542 | 3,485 | 1,600 | 1,565 | 1,322 | 1,306 | 521 | 516 | 99 | 98 |
| Total all species | 137,553 | 130,545 | 10,959 | 9,874 | 23,838 | 22,135 | 29,044 | 27,492 | 73,712 | 71,044 |
| Percent | 100.0 | | 7.9 | | 17.4 | | 21.1 | | 53.6 | |

1/ International 1/4-inch log rule. All board foot volumes in the remaining tables are by International 1/4-inch log rule.

2/ Scribner log rule.

3/ Includes 296 MM bd. ft. of mountain hemlock, 198 MM bd. ft. of Sitka spruce, 98 MM bd. ft. of western white pine, 42 MM bd. ft. of Port Orford cedar, 2 MM bd. ft. of western red cedar, and 193 MM bd.ft. of Bishop pine, California nutmeg, knobcone pine, weeping spruce, and western yew combined.

4/ Includes 308 MM bd. ft. of California black oak, 126 MM bd. ft. of canyon live oak, 105 MM bd.ft. of alder, 60 MM bd. ft. of chinquapin, 50 MM bd. ft. of Garry oak, and 74 MM bd. ft. of ash, coast live oak, interior live oak, laurel, and maple combined.

Table 11.- Net volume1/ of live saw timber on commercial forest land by species and by age class of timber stand, 1948

| Species | All age classes | | Age class | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| | Million bd. ft. | Pct. | Million board feet | | | | | |
| Softwoods | | | | | | | | |
| Douglas-fir | 78,968 | 57.4 | 10,216 | 39,769 | 15,439 | 12,762 | 214 | 568 |
| Redwood | 38,778 | 28.2 | 16,619 | 12,481 | 3,036 | 6,162 | 240 | 240 |
| White fir | 5,030 | 3.7 | 50 | 2,096 | 1,108 | 1,774 | 2 | - |
| Sugar pine | 4,694 | 3.4 | 178 | 3,312 | 739 | 90 | 372 | 3 |
| Ponderosa and Jeffrey pines | 2,582 | 1.9 | 112 | 1,491 | 722 | 257 | - | - |
| Grand fir | 1,291 | 0.9 | 99 | 202 | 126 | 864 | - | - |
| California red fir | 712 | 0.5 | 12 | 619 | 80 | 1 | - | - |
| Incense cedar | 591 | 0.4 | 5 | 216 | 262 | 108 | - | - |
| Western hemlock | 536 | 0.4 | 251 | 194 | - | 91 | - | - |
| Other | 829 | 0.6 | 41 | 489 | 129 | 57 | 113 | - |
| Total softwoods | 134,011 | 97.4 | 27,583 | 60,869 | 21,641 | 22,166 | 941 | 811 |
| Hardwoods | | | | | | | | |
| Tanoak | 1,967 | 1.4 | 132 | 1,058 | 525 | 138 | 1 | 113 |
| Madrone | 852 | 0.6 | 36 | 459 | 160 | 131 | 1 | 65 |
| Other | 723 | 0.6 | 36 | 194 | 159 | 201 | 6 | 127 |
| Total hardwoods | 3,542 | 2.6 | 204 | 1,711 | 844 | 470 | 8 | 305 |
| Total all species | 137,553 | 100.0 | 27,787 | 62,580 | 22,485 | 22,636 | 949 | 1,116 |
| Percent | | 100.0 | 20.2 | 45.5 | 16.3 | 16.5 | 0.7 | 0.8 |
| Average volume per acre (bd.ft.) | 32,457 | | 97,498 | 40,742 | 27,454 | 25,635 | 4,275 | 2,264 |

1/ Log scale, International 1/4-inch rule.

Table 12.- Net volume[1/] of live saw timber on commercial forest land by ownership class and by age class of timber stand, 1948

| Ownership class | All age classes | | Age class | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| | Million bd.ft. | Pct. | Million board feet | | | | | |
| Public | | | | | | | | |
| National forest | 32,559 | 23.7 | 1,917 | 22,199 | 6,803 | 1,263 | 126 | 251 |
| Other Federal | 6,699 | 4.9 | 1,383 | 4,169 | 651 | 412 | 16 | 68 |
| State, County and Municipal | 3,251 | 2.3 | 289 | 1,451 | 606 | 867 | 23 | 15 |
| Total Public | 42,509 | 30.9 | 3,589 | 27,819 | 8,060 | 2,542 | 165 | 334 |
| Private | | | | | | | | |
| Timber operating company and individual | 35,303 | 25.7 | 15,178 | 12,782 | 3,195 | 3,637 | 383 | 128 |
| Timber holding company and individual | 24,174 | 17.6 | 6,960 | 11,331 | 2,276 | 3,419 | 115 | 73 |
| Range livestock farming company and individual | 22,357 | 16.2 | 1,376 | 7,032 | 6,025 | 7,549 | 120 | 255 |
| Other farmers | 4,361 | 3.2 | 350 | 1,162 | 817 | 1,856 | 41 | 135 |
| Other classified[2/] | 8,341 | 6.1 | 308 | 2,450 | 2,084 | 3,208 | 114 | 177 |
| Unclassified | 508 | 0.3 | 26 | 4 | 28 | 425 | 11 | 14 |
| Total Private | 95,044 | 69.1 | 24,198 | 34,761 | 14,425 | 20,094 | 784 | 782 |
| All ownerships | 137,553 | 100.0 | 27,787 | 62,580 | 22,485 | 22,636 | 949 | 1,116 |

1/ Log scale, International 1/4-inch rule.
2/ Includes recreational property owners as well as property owners not logically fitting the classes listed.

Table 13.- Net volume of growing stock[1/] on commercial forest land by species and by diameter groups, 1948

| Species | Total | Diameter class groups | | | | |
|---|---|---|---|---|---|---|
| | | 5.0 - 10.9" d.b.h. | 11.0 - 20.9" d.b.h. | 21.0 - 30.9" d.b.h. | 31.0 - 40.9" d.b.h. | 41.0" and larger d.b.h. |
| | Million cubic feet | | | | | |
| Softwoods | | | | | | |
| Douglas-fir | 13,014 | 420 | 1,436 | 2,349 | 2,928 | 5,881 |
| Redwood | 7,568 | 151 | 688 | 800 | 849 | 5,080 |
| White fir | 954 | 68 | 203 | 311 | 227 | 145 |
| Sugar pine | 761 | 22 | 57 | 152 | 192 | 338 |
| Ponderosa and Jeffrey pines | 437 | 13 | 56 | 143 | 146 | 79 |
| Grand fir | 244 | 19 | 56 | 62 | 33 | 74 |
| California red fir | 126 | 4 | 20 | 51 | 34 | 17 |
| Incense cedar | 126 | 6 | 15 | 31 | 31 | 43 |
| Western hemlock | 109 | 7 | 26 | 23 | 26 | 27 |
| Other | 183 | 23 | 96 | 34 | 2 | 28 |
| Total softwoods | 23,522 | 733 | 2,653 | 3,956 | 4,468 | 11,712 |
| Hardwoods | | | | | | |
| Tanoak | 1,063 | 278 | 365 | 278 | 113 | 29 |
| Madrone | 615 | 205 | 212 | 125 | 65 | 8 |
| Other | 577 | 319 | 141 | 98 | 19 | - |
| Total hardwoods | 2,255 | 802 | 718 | 501 | 197 | 37 |
| Total all species | 25,777 | 1,535 | 3,371 | 4,457 | 4,665 | 11,749 |
| Percent | 100.0 | 6.0 | 13.1 | 17.3 | 18.1 | 45.5 |

1/ Net cubic volume of live saw-timber and pole-timber trees from stump to a minimum 4.0-inch top (central stem) inside bark.

Table 14.- Net volume of growing stock[1/] on commercial forest land by species and by age class of timber stand, 1948

| Species | All age classes | | Age class | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| | Million cu. ft. | Pct. | ---------- Million cubic feet ---------- | | | | | |
| Softwoods | | | | | | | | |
| Douglas-fir | 13,014 | 50.5 | 1,510 | 6,241 | 2,764 | 2,355 | 37 | 107 |
| Redwood | 7,568 | 29.4 | 3,195 | 2,421 | 544 | 1,268 | 88 | 52 |
| White fir | 954 | 3.7 | 10 | 378 | 241 | 321 | 4 | - |
| Sugar pine | 761 | 3.0 | 27 | 517 | 146 | 17 | 53 | 1 |
| Ponderosa and Jeffrey pines | 437 | 1.7 | 17 | 239 | 130 | 51 | - | - |
| Grand fir | 244 | 0.9 | 17 | 35 | 20 | 167 | - | 5 |
| California red fir | 126 | 0.5 | 2 | 103 | 21 | (2/) | - | - |
| Incense cedar | 126 | 0.5 | 1 | 46 | 57 | 22 | - | - |
| Western hemlock | 109 | 0.4 | 48 | 39 | - | 22 | - | - |
| Other | 183 | 0.7 | 7 | 101 | 27 | 22 | 26 | - |
| Total softwoods | 23,522 | 91.3 | 4,834 | 10,120 | 3,950 | 4,245 | 208 | 165 |
| Hardwoods | | | | | | | | |
| Tanoak | 1,063 | 4.1 | 71 | 557 | 276 | 84 | 8 | 67 |
| Madrone | 615 | 2.4 | 20 | 280 | 122 | 124 | 8 | 61 |
| Other | 577 | 2.2 | 14 | 142 | 122 | 166 | 21 | 112 |
| Total hardwoods | 2,255 | 8.7 | 105 | 979 | 520 | 374 | 37 | 240 |
| Total all species | 25,777 | 100.0 | 4,939 | 11,099 | 4,470 | 4,619 | 245 | 405 |
| Percent | | 100.0 | 19.2 | 43.0 | 17.3 | 17.9 | 1.0 | 1.6 |
| Average volume per acre (cu.ft.) | 6,082 | | 17,330 | 7,226 | 5,458 | 5,231 | 1,104 | 822 |

1/ Net cubic foot volume of live saw-timber and pole-timber trees from stump to a minimum 4.0-inch top (central stem) inside bark.

2/ Less than 0.5 million cubic feet.

Table 15.- Net volume of growing stock1/ on commercial forest land by ownership class and by age class of timber stand, 1948

| Ownership class | All age classes | | Age class | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Old growth | Old growth-young growth | Young growth-old growth | Large young growth | Small young growth | Non-stocked |
| | Million cu. ft. | Pct. | Million cubic feet | | | | | |
| Public | | | | | | | | |
| National forest | 5,813 | 22.6 | 300 | 3,790 | 1,341 | 259 | 32 | 91 |
| Other Federal | 1,221 | 4.7 | 244 | 732 | 131 | 85 | 3 | 26 |
| State, County, and Municipal | 633 | 2.4 | 51 | 271 | 123 | 176 | 6 | 6 |
| Total Public | 7,667 | 29.7 | 595 | 4,793 | 1,595 | 520 | 41 | 123 |
| Private | | | | | | | | |
| Timber operating company and individual | 6,634 | 25.8 | 2,738 | 2,370 | 645 | 736 | 99 | 46 |
| Timber holding company and individual | 4,492 | 17.4 | 1,252 | 2,053 | 453 | 678 | 30 | 26 |
| Range livestock farming company and individual | 4,321 | 16.8 | 235 | 1,240 | 1,192 | 1,531 | 31 | 92 |
| Other farmers | 881 | 3.4 | 62 | 207 | 163 | 389 | 11 | 49 |
| Other classified2/ | 1,675 | 6.5 | 52 | 435 | 416 | 678 | 30 | 64 |
| Unclassified | 107 | 0.4 | 5 | 1 | 6 | 87 | 3 | 5 |
| Total Private | 18,110 | 70.3 | 4,344 | 6,306 | 2,875 | 4,099 | 204 | 282 |
| All ownerships | 25,777 | 100.0 | 4,939 | 11,099 | 4,470 | 4,619 | 245 | 405 |

1/ Net cubic foot volume of live saw-timber and pole-timber trees from stump to a minimum 4.0-inch top (central stem) inside bark.

2/ Includes recreational property owners as well as property owners not logically fitting the classes listed.

Table 16.- Live all-timber volume on commercial forest land by species, class of material, and tree-size class, 1948

| Species | Total | Growing stock | | | Other material | | |
|---|---|---|---|---|---|---|---|
| | | Total | Saw-timber trees | Pole-timber trees | Total | Cull trees | Hard-wood limbs |
| | ---------- Million cubic feet ---------- | | | | | | |
| Softwoods | | | | | | | |
| Douglas-fir | 13,439 | 13,014 | 12,594 | 420 | 425 | 425 | - |
| Redwood | 7,720 | 7,568 | 7,417 | 151 | 152 | 152 | - |
| White fir | 955 | 954 | 886 | 68 | 1 | 1 | - |
| Sugar pine | 761 | 761 | 739 | 22 | - | - | - |
| Ponderosa and Jeffrey pines | 438 | 437 | 424 | 13 | 1 | 1 | - |
| Grand fir | 252 | 244 | 225 | 19 | 8 | 8 | - |
| California red fir | 128 | 126 | 122 | 4 | 2 | 2 | - |
| Incense cedar | 126 | 126 | 120 | 6 | - | - | - |
| Western hemlock | 121 | 109 | 102 | 7 | 12 | 12 | - |
| Other | 184 | 183 | 160 | 23 | 1 | 1 | - |
| Total softwoods | 24,124 | 23,522 | 22,789 | 733 | 602 | 602 | - |
| Hardwoods | | | | | | | |
| Tanoak | 1,501 | 1,063 | 785 | 278 | 438 | - | 438 |
| Madrone | 948 | 615 | 410 | 205 | 333 | - | 333 |
| Other | 1,170 | 577 | 258 | 319 | 593 | 435 | 158 |
| Total hardwoods | 3,619 | 2,255 | 1,453 | 802 | 1,364 | 435 | 929 |
| Total all species | 27,743 | 25,777 | 24,242 | 1,535 | 1,966 | 1,037 | 929 |

Table 17.- Average annual growth of live saw timber on commercial forest land by age class of timber and by species group, 1948

| Age class | Total | | Softwoods | | Hardwoods | | Per acre | |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net | Gross | Net | Gross | Net | Gross | Net |
| | Million bd.ft. 1/ | | | | | | Bd.ft. | |
| Old growth 2/ | 648 | 237 | 594 | 224 | 54 | 13 | 356 | 130 |
| Young growth-old growth | 285 | 200 | 275 | 192 | 10 | 8 | 348 | 244 |
| Large young growth | 613 | 592 | 607 | 588 | 6 | 4 | 694 | 670 |
| Small young growth | 33 | 27 | 33 | 28 | (3/) | -1 | 149 | 122 |
| Nonstocked | 10 | 7 | 7 | 5 | 3 | 2 | 20 | 14 |
| Total | 1,589 | 1,063 | 1,516 | 1,037 | 73 | 26 | 375 | 251 |

1/ Log scale, International 1/4-inch rule.
2/ This class includes both the old growth and the old growth-young growth stands.
3/ Less than 0.5 million board feet.

Table 18.- Average annual growth of growing stock on commercial forest land by age class of timber and by species group, 1948

| Age class | Total | | Softwoods | | Hardwoods | | Per acre | |
|---|---|---|---|---|---|---|---|---|
| | Gross | Net | Gross | Net | Gross | Net | Gross | Net |
| | Million cu.ft. | | | | | | Cu.ft. | |
| Old growth 1/ | 111 | 31 | 98 | 33 | 13 | -2 | 61 | 17 |
| Young growth-old growth | 57 | 39 | 48 | 32 | 9 | 7 | 70 | 48 |
| Large young growth | 120 | 115 | 115 | 111 | 5 | 4 | 136 | 130 |
| Small young growth | 8 | 7 | 5 | 5 | 3 | 2 | 36 | 32 |
| Nonstocked | 4 | 3 | 1 | 1 | 3 | 2 | 8 | 6 |
| Total | 300 | 195 | 267 | 182 | 33 | 13 | 71 | 46 |

1/ This class includes both the old growth and the old growth-young growth stands.

Table 19.- Average annual net growth of live saw timber and growing stock on commercial forest land by species, 1948

| Species | Saw timber | Growing stock |
|---|---|---|
| | Million bd.ft. 1/ | Million cu.ft. |
| **Softwoods** | | |
| Douglas-fir | 536 | 88 |
| Redwood | 380 | 72 |
| White fir | 43 | 7 |
| Sugar pine | 13 | 3 |
| Ponderosa and Jeffrey pines | 3 | 1 |
| Other | 62 | 11 |
| All softwoods | 1,037 | 182 |
| **Hardwoods** | | |
| Tanoak | 21 | 5 |
| Other | 5 | 8 |
| All hardwoods | 26 | 13 |
| Total all species | 1,063 | 195 |

1/ Log scale, International 1/4-inch rule.

Table 20.- Commodity drain[1] of live saw timber and growing stock on commercial forest land by species group and by product, 1947-1949 average

| Product | Live saw timber | | | Growing stock | | |
|---|---|---|---|---|---|---|
| | Total | Softwood | Hardwood | Total | Softwood | Hardwood |
| | --- Million bd.ft.[2] --- | | | ---- Million cu.ft. ---- | | |
| Sawlogs | 1,586 | 1,586 | (3) | 292.6 | 292.6 | (3) |
| Veneer logs | 72 | 72 | 0 | 11.5 | 11.5 | 0 |
| Split products[4] | 63 | 63 | 0 | 6.8 | 6.8 | 0 |
| Other[5] | 21 | 16 | 5 | 4.3 | 2.9 | 1.4 |
| All products | 1,742 | 1,737 | 5 | 315.2 | 313.8 | 1.4 |

1/ Includes logging waste.
2/ Log scale, International 1/4-inch log rule.
3/ Negligible.
4/ Includes fence posts, ties, grapestakes, shingle bolts, shakes, and other products split from redwood.
5/ Includes cooperage logs, pulpwood logs, fuelwood, and small volumes of poles, piling, mine timbers, and waste wood from tanoak operations.

Table 21.- Commodity drain[1] of live saw timber and growing stock on commercial forest land by species. 1947-49 average

| Species | Live saw timber | Growing stock |
|---|---|---|
| | Million bd.ft.[2] | Million cu.ft. |
| Redwood | 935 | 159.1 |
| Douglas-fir | 765 | 147.5 |
| Other[3] | 42 | 8.6 |
| All species | 1,742 | 315.2 |

1/ Includes logging waste.
2/ Log scale, International 1/4-inch log rule.
3/ Grand fir, ponderosa and sugar pines, Sitka spruce, Port Orford cedar, western hemlock, and hardwoods.

Table 22.- Estimated lumber production and number of active sawmills by mill-size class, 1948

| Mill-size class (Annual production, M bd.ft.) | Lumber produced | | Active sawmills | |
|---|---|---|---|---|
| | M bd. ft. | Pct. | Number | Pct. |
| 50,000 and over | 296,930 | 21.9 | 5 | 1.3 |
| 25,000 to 49,999 | 222,160 | 16.4 | 7 | 1.8 |
| 15,000 to 24,999 | 58,430 | 4.3 | 3 | 0.8 |
| 10,000 to 14,999 | 167,100 | 12.3 | 13 | 3.3 |
| 5,000 to 9,999 | 229,310 | 16.9 | 32 | 8.1 |
| 1,000 to 4,999 | 298,890 | 22.1 | 116 | 29.5 |
| 500 to 999 | 53,240 | 4.0 | 77 | 19.6 |
| 50 to 499 | 28,820 | 2.1 | 122 | 31.0 |
| Less than 50 | 340 | - | 18 | 4.6 |
| All classes | 1,355,220 | 100.0 | 393 | 100.0 |

The following tables will be found in all Forest Survey or subregional reports in order that readers may combine or compare the data with similar data for several such areas.

Table 23.- Land area, by major classes of land, 1948

| Class of land | Area |
|---|---|
| | Thousand acres |
| Forest: | |
| Commercial | 4,238 |
| Noncommercial: | |
| Reserved from commercial timber use | 186 |
| Unproductive for timber use 1/ | 1,382 |
| Total | 5,806 |
| Nonforest 2/ | 1,772 |
| Total, all classes | 7,578 |

1/ Includes 28,000 acres withdrawn for special uses.
2/ Includes 23,000 acres of water according to Survey standards of area classification but defined by the Bureau of Census as land.

Table 24.- Commercial forest land area, by ownership and by stand-size classes.1/ 1948

| Ownership class | Total | Saw-timber stands | Pole-timber stands | Seedling and sapling stands2/ | Nonstocked and other areas3/ |
|---|---|---|---|---|---|
| | ---------- Thousand acres ---------- | | | | |
| Federally owned or managed: | | | | | |
| National forest | 1,006 | 865 | 30 | - | 111 |
| Indian | 103 | 88 | 2 | - | 13 |
| Other | 98 | 79 | 2 | - | 17 |
| Total | 1,207 | 1,032 | 34 | - | 141 |
| State | 102 | 92 | 5 | - | 5 |
| County and municipal | 7 | 5 | (4/) | - | 2 |
| Private | | | | | |
| Farm | 1,057 | 846 | 38 | - | 173 |
| Industrial and other | 1,865 | 1,548 | 145 | - | 172 |
| Total | 2,922 | 2,394 | 183 | - | 345 |
| All ownerships | 4,238 | 3,523 | 222 | - | 493 |

1/ See relationship of stand-size classes to age classes, page 40.
2/ Areas of seedlings and saplings are not shown separately as they occurred in such small and widely scattered units that separate photo classification was not practicable. These areas were included with other stand-size classes, chiefly pole timber and nonstocked.
3/ Includes areas not classified elsewhere.
4/ Less than 500 acres.

Table 25.- Area of commercial forest land, by major forest types, 1948

| Forest type[1/] | Thousand acres |
|---|---|
| Redwood | 1,918 |
| Douglas-fir | 2,265 |
| Fir | 44 |
| Pine | 11 |
| Total | 4,238 |

1/ Since the Forest Survey timber stand classification does not include a mixed type, the Pine--Douglas-fir--Fir type of the California Region has been subdivided into the pine, Douglas-fir, and fir types on the basis of predominant species.

Table 26.- Net volume of live saw timber and growing stock on commercial forest land, by stand-size class, 1948

| Stand-size class | Saw timber | Growing stock |
|---|---|---|
| | Million bd.ft.1/ | Million cu.ft. |
| Saw-timber stands | 135,488 | 25,127 |
| Pole-timber stands | 949 | 245 |
| Seedling and sapling stands | - | - |
| Nonstocked and other areas not classified elsewhere | 1,116 | 405 |
| Total | 137,553 | 25,777 |

1/ Log scale, International 1/4-inch rule.

Table 27.- Net volume of live saw timber and growing stock on commercial forest land, by ownership class, 1948

| Ownership class | Saw timber | Growing stock |
|---|---|---|
| | Million bd.ft.1/ | Million cu.ft. |
| Federally owned or managed: | | |
| National forest | 32,559 | 5,813 |
| Indian | 3,551 | 626 |
| Other | 3,148 | 595 |
| Total | 39,258 | 7,034 |
| State | 3,086 | 602 |
| County and municipal | 165 | 31 |
| Private: | | |
| Farm | 26,718 | 5,202 |
| Industrial and other | 68,326 | 12,908 |
| Total | 95,044 | 18,110 |
| All ownerships | 137,553 | 25,777 |

1/ Log scale, International 1/4-inch log rule.

Table 28.- Net volume of live saw timber and growing stock on commercial forest land, by species, 1948

| Species | Saw timber | Growing stock |
|---|---|---|
| | Million bd.ft.1/ | Million cu.ft. |
| **Softwoods** | | |
| Douglas-fir | 78,968 | 13,014 |
| Redwood | 38,778 | 7,568 |
| White fir | 5,030 | 954 |
| Sugar pine | 4,694 | 761 |
| Ponderosa and Jeffrey pines | 2,582 | 437 |
| Grand fir | 1,291 | 244 |
| California red fir | 712 | 126 |
| Incense cedar | 591 | 126 |
| Western hemlock | 536 | 109 |
| Sitka spruce | 198 | 29 |
| Western white pine | 98 | 21 |
| Western red cedar | 2 | (2/) |
| Other3/ | 531 | 133 |
| Total | 134,011 | 23,522 |
| **Hardwoods** | | |
| Tanoak | 1,967 | 1,063 |
| Madrone | 852 | 615 |
| Alder | 105 | 58 |
| Other4/ | 618 | 519 |
| Total | 3,542 | 2,255 |
| All species | 137,553 | 25,777 |

1/ Log scale, International 1/4-inch rule.
2/ Less than 0.5 million cubic feet.
3/ Includes mountain hemlock, Port Orford cedar, Bishop pine, California nutmeg, knobcone pine, weeping spruce, and western yew.
4/ Includes California black oak, canyon live oak, chinquapin, Garry oak, ash, coast live oak, interior live oak, laurel, and maple.

Table 29.- Net volume of live saw timber on commercial forest land by diameter class groups and species, 1948

| Species | Diameter class groups | | | | Total |
|---|---|---|---|---|---|
| | 11.0 - 20.9" d.b.h. | 21.0 - 30.9" d.b.h. | 31.0 - 40.9" d.b.h. | 41.0" and larger d.b.h. | |
| | Million bd. ft.[1] | | | | |
| Softwoods: | | | | | |
| Douglas-fir | 4,475 | 13,777 | 19,628 | 41,088 | 78,968 |
| Redwood | 2,840 | 4,045 | 4,469 | 27,424 | 38,778 |
| White fir | 835 | 1,814 | 1,431 | 950 | 5,030 |
| Sugar pine | 187 | 898 | 1,251 | 2,358 | 4,694 |
| Ponderosa and Jeffrey pines | 194 | 837 | 975 | 576 | 2,582 |
| Grand fir | 211 | 365 | 213 | 502 | 1,291 |
| California red fir | 59 | 307 | 225 | 121 | 712 |
| Incense cedar | 39 | 146 | 161 | 245 | 591 |
| Western hemlock | 97 | 131 | 154 | 154 | 536 |
| Other[2] | 422 | 196 | 16 | 195 | 829 |
| Total | 9,359 | 22,516 | 28,523 | 73,613 | 134,011 |
| Hardwoods: | | | | | |
| Tanoak | 829 | 736 | 315 | 87 | 1,967 |
| Madrone | 429 | 279 | 132 | 12 | 852 |
| Other[3] | 342 | 307 | 74 | - | 723 |
| Total | 1,600 | 1,322 | 521 | 99 | 3,542 |
| All species | 10,959 | 23,838 | 29,044 | 73,712 | 137,553 |

1/ Log scale, International 1/4-inch rule.

2/ Includes 296 MM bd. ft. of mountain hemlock, 198 MM bd. ft. of Sitka spruce, 98 MM bd. ft. of western white pine, 42 MM bd. ft. of Port Orford cedar, 2 MM bd. ft. of western red cedar, and 193 MM bd. ft. of Bishop pine, California nutmeg, knobcone pine, weeping spruce, and western yew combined.

3/ Includes 308 MM bd. ft. of California black oak, 126 MM bd. ft. of canyon live oak, 105 MM bd. ft. of alder, 60 MM bd. ft. of chinquapin, 50 MM bd. ft. of Garry oak, and 74 MM bd. ft. of ash, coast live oak, interior live oak, laurel, and maple combined.

Table 30.- Net volume of all timber on commercial forest land, by class of material and species group, 1948

| Class of material | Total | Softwoods | Hardwoods |
|---|---|---|---|
| | ---------- Million cu. ft. ---------- | | |
| Growing stock | | | |
| Saw-timber trees | | | |
| Sawlog portion | 20,512 | 19,759 | 753 |
| Upper stem portion | 3,730 | 3,030 | 700 |
| Total | 24,242 | 22,789 | 1,453 |
| Pole timber trees | 1,535 | 733 | 802 |
| Total growing stock | 25,777 | 23,522 | 2,255 |
| Other material | | | |
| Sound cull trees | 316 | 20 | 296 |
| Rotten cull trees | 721 | 582 | 139 |
| Hardwood limbs | 929 | - | 929 |
| Salvable dead trees | 101 | 101 | - |
| Total other material | 2,067 | 703 | 1,364 |
| Total, all timber | 27,844 | 24,225 | 3,619 |

Table 31.- Net annual growth, annual mortality, and commodity drain on live saw timber and growing stock on commercial forest land by species groups, 1948

| Item | Saw timber | | | Growing stock | | |
|---|---|---|---|---|---|---|
| | Total | Softwoods | Hardwoods | Total | Softwoods | Hardwoods |
| | --- Million bd.ft. 1/ ---- | | | ---- Million cu.ft. ---- | | |
| Net annual growth | 1,063 | 1,037 | 26 | 195.0 | 182.0 | 13.0 |
| Annual mortality | 526 | 479 | 47 | 105.0 | 85.0 | 20.0 |
| Commodity drain | | | | | | |
| Timber products | 1,360 | 1,360 | (2/) | 211.2 | 211.2 | (2/) |
| Logging waste | 382 | 377 | 3/5 | 104.0 | 102.6 | 3/1.4 |
| Total | 1,742 | 1,737 | 5 | 315.2 | 313.8 | 1.4 |

1/ Log scale, International 1/4-inch log rule.
2/ Negligible.
3/ Primarily tanoak wood left from tan-bark operations.

Table 32.- Total output of timber products and commodity drain on live saw timber and growing stock, 1947-49 average

| Product | Volume of products cut[1] | | | Commodity drain on saw timber | | | Commodity drain on growing stock | | |
|---|---|---|---|---|---|---|---|---|---|
| | Standard unit | Number | M Cu.ft. | Total | Soft-woods | Hard-woods | Total | Soft-woods | Hard-woods |
| | | | | ---Million bd.ft.--- | | | --- Million cu.ft.--- | | |
| Sawlogs | M bd.ft.[2] | 1,270,275 | 200,703 | 1,586 | 1,586 | (3) | 292.6 | 292.6 | (4) |
| Veneer logs and bolts | M bd.ft.[2] | 57,734 | 7,736 | 72 | 72 | (3) | 11.5 | 11.5 | (4) |
| Cooperage logs & bolts | M bd.ft.[2] | 7,806 | 1,046 | 10 | 10 | - | 1.6 | 1.6 | - |
| Pulpwood logs | M bd.ft.[2] | 2,707 | 485 | 3 | 3 | - | 0.7 | 0.7 | - |
| Pulpwood bolts[5] | Std.cords[6] | - | - | - | - | - | - | - | - |
| Fuelwood[5] | Std.cords[6] | 23,500 | 2,068 | 3 | 3 | (3) | 0.6 | 0.6 | (4) |
| Piling | M lin. ft. | 75 | 41 | (3) | (3) | - | (4) | (4) | - |
| Poles | M pieces | 2 | 27 | (3) | (3) | - | (4) | (4) | - |
| Posts | M pieces | 515 | 901 | 8 | 8 | - | 1.3 | 1.3 | - |
| Hewn ties | M pieces | 73 | 196 | 3 | 3 | - | 0.3 | 0.3 | - |
| Mine timbers | M cu.ft. | - | (7) | (3) | (3) | - | (4) | (4) | - |
| Miscellaneous | M cu.ft. | 4,029 | [8]4,029 | 57 | 52 | [9]5 | 6.6 | 5.2 | [9]1.4 |
| Total | xxxx | xxxx | 217,232 | 1,742 | 1,737 | 5 | 315.2 | 313.8 | 1.4 |

1/ Includes material from both growing stock and other miscellaneous sources.
2/ International 1/4-inch rule.
3/ Less than 0.5 million board feet.
4/ Less than 0.5 million cubic feet.
5/ Excludes material derived from mill waste.
6/ Standard cords rough wood basis. A pile of stacked wood 4 feet x 4 feet x 8 feet within its outside surface.
7/ Less than 500 cubic feet.
8/ Includes 2,150 M cubic feet of shingle and shake bolts and 1,879 M cubic feet of miscellaneous split products (primarily grape stakes).
9/ Waste wood from tanbark operations.

## PROCEDURES

### Area Delineation

To determine the extent, location, and condition of all forest lands in the Redwood--Douglas-fir subregion, aerial photographs were delineated on the basis of (1) present cover of vegetation, (2) suitability for growing timber crops, and (3) density and age class of timber stands. The minimum unit classified and mapped under the Federal Survey was forty acres. However, under a cooperative agreement set up between the State Division of Forestry and the Experiment Station, the California State Legislature provided funds for intensification of the survey on wild lands outside the national forest boundaries. On the latter area, classification and mapping were extended to a 10-acre minimum to secure detailed information on vegetation types and soils not obtainable with available Federal Survey funds. Timber, range, and watershed values are so commingled on these lands as to present difficult problems of land management and use.

In some cases, hardwood and chaparral areas nonstocked with commercial conifers were difficult to classify as to their suitability for growing timber crops. If located in a timber zone where commercial conifers normally grow, they were classified as commercial forest land. However, soil surveys on timbered areas within the subregion have demonstrated that some nonstocked areas have soils too shallow to support timber growth. Inasmuch as the same situation probably exists throughout the entire subregion, some of the nonstocked areas classified in this report as commercial forest land must reside in the doubtful category until soil surveys provide a basis for final classification.

### Transfer to base maps

After photo delineation was completed, Timber Stand Maps were prepared by transferring photo classifications to 7-1/2-minute quadrangle size base maps at a common scale of 2 inches to the mile. These maps are available for the timber producing area of the Redwood--Douglas-fir subregion. Kind and density of vegetation, age-structure and density of coniferous timber stands, and other information pertinent to the vegetative resource are shown. As a final preparation for area measurement other related information such as political and economic subdivisions, ownership, and commercial timber type boundaries were marked along east-west transect lines spaced 2 miles apart. Inasmuch as there were changes in the timber classifications caused by cutting and fire since the date of aerial photography, adjustments of age density classes were made along these transect lines following field examination so that class acreages when compiled would show conditions as of the inventory year.

### Stand-size class determination

The national pattern of data presentation established for the Forest Survey provides for the classification of commercial forest land according to stand-size class. In order to present the California age classes in the terms required, the following system of conversion was established:

| Age class | Stand-size class |
|---|---|
| Old growth<br>Old growth-young growth | Old growth saw timber |
| Young growth-old growth<br>Large young growth | Young growth saw timber |
| Small young growth | Pole timber |
| Nonstocked | Nonstocked |

Forest stands classified as saw timber by this grouping conform closely to the National Forest Survey definitions. Areas of seedlings and saplings are not shown separately because these areas occurred in such small and widely scattered units that separate classification was not practicable. Those seedling and sapling stands of 40 acres or more which did occur were included with other stand-size classes, chiefly pole timber and nonstocked.

## Ownership determination

Under a cooperative agreement with the Station, the Bureau of Agricultural Economics has studied forest land ownership in conjunction with the Forest Survey in California. This study has provided detailed information about private forest and farm-forest holdings which is necessary in the development of sound subregion and State forest land policies and effective forest management plans.

Information on land ownership in the Redwood--Douglas-fir subregion was obtained from the county tax assessment rolls, and other official records of the County Assessors and Tax Collectors using a line sampling technique.1/ Parallel lines, spaced two miles apart, were drawn on the quadrangle base maps. Ownership boundaries, taken from county plat maps, were marked along these lines. The proportion of the total line traversing an ownership class was taken as the proportion of the total acreage in that particular class. This acreage was classified further by measuring the intercepts of the various vegetation and timber stand classifications used in the Forest Survey.

Owners of properties traversed by the sample lines constituted the ownership sample. The county property records provided the address of the owner, and the acreage of each parcel of land in the sample. These total land acreage figures were used to classify private ownerships and land area by size. Each sample owner was mailed a questionnaire card by the State Division of Forestry. Answers received on these cards provided information on how the land was used, how and why the present owner

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1/ Details of the line sampling method used for estimating area and procedure for estimating number of owners are given in "A New Approach to Forest Ownership Surveys," by A. A. Hasel and Adon Poli, Land Economics, Vol. XXV, No. 1, Feb. 1949, pp. 1-10.

acquired it, why he holds it, and his principal occupation. These data were used to classify the sample ownerships as to type of ownership. Similar information about the land of the nonrespondents was obtained by a field follow-up, in which key informants were questioned in local public offices and in the communities where the owners have their land.2/

## Area measurement and compilation

To estimate the areas, parallel lines spaced 2 miles apart were drawn east and west on the quadrangle base maps. Acreage figures were then obtained by recording line intercept measurements of all pertinent class subdivisions along each of the sample lines transecting the quadrangles. These subdivisions included age, density, and type of timber stands, and type and size of ownership. The ratio of total line length to total area for the quadrangle provided the factor to convert line segments in inches to area in acres. These acreages were then totaled by county, and adjusted if necessary, to check with the Bureau of the Census acreages by counties.3/ Estimated acreage figures appearing in the tables were compiled and summarized by means of punch cards and card tabulating equipment.

## Volume determination

The inventory of timber volumes required the use of both aerial photographs and field sampling. Photographs were used to classify the timber stands being sampled and to guide the field crews in arriving at the sampling location. At each location detailed information was recorded on the timber stand classification, and on the species, size, quality, growth, cull, and mortality of individual trees. The field crew also checked the photo classification of the forest stands in the vicinity of each location.

For locating the field plots, the Redwood--Douglas-fir subregion was subdivided into two units. One unit embraced only the dense and semi-dense old growth saw-timber stands in the redwood type. In this area, the field locations were randomly selected on Timber Stand maps by means of a dot grid overlay and table of random numbers. Three field locations were selected in each 6,000 acres of old growth, and two 1/5-acre plots established at each location for detailed measurements. In the remaining unit of the subregion, the field locations were selected by systematic sampling. Field locations were established 4-3/4 miles apart in cardinal directions. At each location, three 1/5-acre plots were established. In all, 607 field locations (1,457 plots) were established throughout the subregion.

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2/ For a more detailed statement of the overall ownership survey procedure, see "Conducting a Survey of Ownership of Forest Land in California," by Adon Poli, Agricultural Economics Research, Vol. IV, No. 1, Jan. 1952, pp. 8-12.

3/ See "Areas of the United States 1940," U. S. Bureau of the Census.

From the data collected at the field locations, the average net volume per acre was determined for all age-density classes of timber. Some of the age-density classes were grouped to provide more accurate volume estimates. These groupings were based on statistical tests designed to give the least error in the final volume estimates. Total volume estimates by age class, stand-size class, area, and ownership breakdowns were finally determined by applying age-density class volume per acre figures to the acreages of commercial forest land in those classes. Volume estimates were compiled in board feet, by both the Scribner and International 1/4-inch log rules, and in cubic feet, using local volume tables based on standard volume tables prepared by the California Forest and Range Experiment Station.

## Cull and breakage determinations

Net board foot and cubic foot volumes were obtained by deducting cull and breakage from gross volumes of the growing stock. The deductions for cull and breakage were based on studies made by the Division of Forest Pathology, Bureau of Plant Industry, Soils, and Agricultural Engineering, especially for this purpose.4/ The cull and breakage study in the Redwood--Douglas-fir subregion was a joint undertaking with the Experiment Station. Cull and breakage are expressed as a composite factor because breakage is so closely related to defect (decay) that it is difficult to separate the two factors, and because in the West both Forest Service and commercial cruising practices combine cull and breakage as one figure.

Deductions for cull and breakage varied between species and species groups and by diameter class within species. Two types of cull factors are involved. "One type, based on the total cull in a tree, regardless of source, is called a 'flat factor'. The other, based on cull found in association with specific indicators such as fire scars or broken-out tops, is termed an 'indicator factor.'"5/

At the beginning of the Survey work in the redwood region, indicator factors were not available, so flat cull deductions--which varied by broad diameter classes and between the northern and southern portions of the redwood region--were applied to the redwood stands. As cull indicator data became available, cull deductions were made on an individual tree basis. In addition, an average breakage deduction was applied which varied by diameter class.

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4/ "Cull Factors for Forest-Tree Species in Northwestern California," Forest Survey Release No. 7, June 1, 1950. Although both cull and breakage data were collected in this study, only the data on cull were published. Also, "Cull and Breakage Factors and Other Tree Measurement Tables for Redwood," Forest Survey Release No. 13, May 1952.

5/ Forest Survey Release No. 13, page 2.

For some other conifer species (Douglas-fir and the true firs) that have reliable external cull indicators, such as conks, swollen knots, fire scars, broken tops, etc., deductions for cull were made on an individual tree basis. A flat deduction for breakage was also applied. For the remaining conifers, the average deductions were applied by Dunning's tree classes, with an additional breakage allowance. For hardwoods the deductions were based on average cull and breakage losses determined for each species by the Division of Forest Pathology.

Based on board foot volumes, the average cull and felling breakage deductions for all living redwood and Douglas-fir trees in the Redwood--Douglas-fir subregion were:

| Species | Percent | Species | Percent |
|---|---|---|---|
| Redwood | 24 | Douglas-fir | 21 |

The 1948 deduction in Douglas-fir is considerably less than that made in the Reappraisal of 1945. This is particularly true in the old growth and young growth-old growth stands, where in the earlier inventory 40 percent of the gross board foot volumes was deducted for cull and breakage. A similar comparison is not possible for redwood because detailed data for cull and breakage are not available for the 1945 estimate.

## Site-quality determinations

Three broad site classes: high, medium, and low, were established for expressing the relative capacity of commercial forest land to produce timber crops. Fourteen hundred and fifty-seven separate field site determinations, well distributed over the five major timber types, were grouped into these three classes. For each type the number of site determinations in each site class was expressed as a percentage of all observations within the type. These percentages were then applied to the total area by type to provide estimates of relative site quality.

The relationship between the broad site quality classes--high, medium, and low--and site class and site index ratings of commercial forest land is shown in the following table and explained in the footnotes.

| Broad rating | All types except redwood & Douglas-fir | | Redwood & Douglas-fir types | |
|---|---|---|---|---|
| | Site class1/ | Site index2/ | Site class3/ | Site index4/ |
| High | IA | 200 | I | 200 |
| | | | II | 170 |
| | I | 175 | III | 140 |
| Medium | II | 150 | | |
| | III | 125 | IV | 110 |
| Low | IV | 100 | | |
| | V | 75 | V | 80 |

1/ According to D. Dunning in Station Research Note No. 28, December 1, 1942, "A Site Classification for the Mixed-Conifer Selection Forests of the Sierra Nevada."

2/ The total height that the average dominant trees reach at 300 years of age.

3/ According to R. E. McArdle and W. H. Meyer in U. S. Department of Agriculture Technical Bulletin 201, October 1930, "The Yield of Douglas-fir in the Pacific Northwest."

4/ Average total height of dominant Douglas-fir trees at 100 years of age. In both the redwood and Douglas-fir types, site determinations were based on measurement of Douglas-fir trees.

## Growth determination

The estimate of net annual growth for the subregion was derived from increment borings taken from trees on field sample plots. From measurements of growth over a ten year period, the average periodic annual gross growth for the inventory year was determined for each age-density class. Ingrowth was accounted for in all growth calculations. Gross growth was converted to net growth by subtracting the combined annual mortality from competition, windthrow, insects, disease, and fire for the same decade. The result was the average annual net growth per acre for each age-density class. When age-density classes were inadequately sampled, they were grouped with other classes as required. Total net annual growth for the subregion, then, was the sum of the products of commercial forest land acreages in each age-density class times the net annual growth per acre of that class.

## Mortality determination

One year mortality (from causes other than fire) was recorded on all survey volume sample plots established in the old growth redwood area. In addition, 1-year mortality was recorded on 1-acre sampling strips established in the commercial forest land area outside the old-growth redwood. From these data, per-acre mortality figures were computed by types for all age saw-timber density classes. To these values were added the per-acre fire loss figures computed from data taken from State Division of Forestry and Forest Service fire records.

The estimate of total mortality for the subregion in the inventory year was obtained by the summation of the products of commercial forest land acreages in each age-density class times the per-acre mortality (including fire) of that class.

## Logging waste

The volume of logging waste was determined from plot data collected by Forest Survey in 1948-49. Ninety-six 1/5-acre sample plots were measured in the Redwood--Douglas-fir subregion. These plots were selected so as to sample (1) major forest types, (2) different kinds of logging, and (3) size of operation.

From the field plot measurements, logging waste--in board feet and cubic feet--was expressed as a percentage of timber products produced. These percentages were then applied to the average annual total products output from growing stock for the subregion for the period 1947-1949 to obtain the total logging waste figure. Logging waste, excluding cull and breakage, constituted 28 percent of products produced in board measure (International 1/4-inch rule) and 49 percent in terms of cubic feet.

## Timber products output

The estimate of timber products output in cubic feet and standard units for the Redwood--Douglas-fir subregion was determined from several sources. The sawlog estimate was based on the Bureau of Census report on lumber production for 1947; the survey of 1948 lumber production made by the Station;6/ and information from both the Bureau of Census 1949 estimate of lumber production for the State of California and the State Division of Forestry record of registered operators in the redwood region.

Estimates for veneer logs, cooperage logs, and pulpwood were based on the Station survey for 1948,7/ plus estimates for 1947 and 1949. For fuelwood and split products the estimates were based on 1946 data,8/ and Station estimates made since that year. Estimates for poles, piling, and shingles were based on 1946 and 19509/ data. Lastly, mine timber estimates were based on 1950 data.

Product estimates presented in the tables within the report are average values for the period 1947-1949, inclusive.

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6/ "Estimated Lumber Production in California - 1948" by G. F. Burks. Forest Research Note No. 65, December 8, 1949.

7/ "Production of Logs and Bolts for Plywood, Veneer, Pulpwood, and Cooperage in California, 1948" by R. H. May and A. Simontacchi. Forest Research Note No. 63, September 15, 1949.

8/ "Commodity Production from Commercial Forest Land in California, 1946" by G. F. Burks, H. J. Vaux, R. H. May, and A. Simontacchi. Forest Survey Release No. 6, June 15, 1948.

9/ "Production of Logs and Bolts for Plywood, Pulp, Container Veneer, Shingles, Cooperage, Poles, and Piling in California, 1950" by R. H. May. Forest Research Note No. 79, November 1951.

## ACCURACY OF DATA

Estimates of timber volumes and forest land areas are subject to two general types of errors: (1) nonsampling errors in photo classification, field measurement, tabulation, computation, and compilation, and (2) sampling errors. Errors of the first type were kept to a minimum by frequent checking and close supervision of all phases of the field and office work. When these nonsampling errors are negligible or compensating, then sampling errors provide measures of the reliability of the volume and area estimates and can be computed by statistical methods. Magnitudes of the sampling errors depend on the intensity of the sampling and the variability of the data.

Statistical analysis of the forest area and timber volume data shows the following sampling errors10/ for the Redwood--Douglas-fir subregion.

| Class | Sampling error | |
|---|---|---|
| | Units | Percent |
| Commercial forest land | 43,228 acres | 1.02 |
| Total net volume | 637 million cu.ft. | 2.47 |

Statistics of forest area and timber volume are subject to increasing sampling errors as the acreage or volume decreases. Generally speaking, total estimates warrant greater confidence than do the estimates for elements within the total.

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10/ For one standard error; that is, the chances are two out of three that the calculated acreages and volumes would not differ from the totals that would be obtained by 100 percent measurement by more than the errors shown above.

## DEFINITION OF TERMS

### Area

Forest land area. Includes (a) lands which are at least 10 percent stocked by trees of any size and capable of producing timber or other wood products, or of exerting an influence on the climate or on the water regime; (b) lands from which the trees described in (a) have been removed to less than 10 percent stocking and which have not been developed for other use; (c) afforested areas; and (d) chaparral areas.

Commercial forest land area. Forest land which (a) is producing, or physically capable of producing, usable crops of wood (usually saw timber), (b) economically available now or prospectively, and (c) not withdrawn from timber utilization.

Noncommercial forest land area. Forest land (a) withdrawn from timber utilization through statute, ordinance, or administrative order but which otherwise qualifies as commercial forest land and (b) incapable of yielding usable wood products (usually saw timber) because of adverse site conditions, or so physically inaccessible as to be unavailable economically in the foreseeable future. Includes chaparral land.

Chaparral land area. Lands supporting heavily branched dwarf trees or shrubs, usually evergreen, the crown canopy of which covers more than 50 percent of the ground and whose primary value is watershed protection. The more common chaparral constituents are species of Quercus, Cercocarpus, Garrya, Ceanothus, Arctostaphylos, and Adenostoma. Types dominated by such shrubs as Artemisia, Opuntia, Purshia, Gutierrezia, or semidesert species are not commonly considered chaparral.

Nonforest land area. Land that does not qualify as forest land. Includes land which has never supported forest growth; land from which the forest has been removed to less than 10 percent stocking and has been developed for other use, such as grazing, agricultural, residential, or industrial; all land in thickly populated urban and suburban areas, and water classified by the Bureau of Census as land.

### Timber Stand Classifications

Timber type. An extensive area of commercial forest land or areas reserved from commercial timber use characterized by a predominant commercial conifer species[11] or group of commercial conifer species. Other vegetation (such as minor conifers,[12] hardwoods, and chaparral) and nonvegetation types (such as barren areas) may also occur in subordinate amounts within the same area.

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11/ Commercial conifer species are redwood, Douglas-fir, ponderosa pine, sugar pine, Jeffrey pine, California red fir, white fir, grand fir, incense cedar, Port Orford cedar, western redcedar, Sitka spruce, western hemlock, western white pine, and mountain hemlock.

12/ Minor conifers are Bishop pine, California nutmeg, knobcone pine, weeping spruce, and western yew.

Commercial timber types

a. Redwood. Areas with redwood comprising 20 percent or more of the commercial conifer cover. Douglas-fir occurs as the principal associate of redwood throughout this type.

b. Douglas-fir. Areas with Douglas-fir comprising more than 80 percent of the commercial conifer cover; or mixtures of Douglas-fir and the true firs in which Douglas-fir comprises 20 percent or more of the commercial conifer cover.

c. Pine--Douglas-fir--Fir. Areas with mixtures of the commercial pines and either Douglas-fir or the true firs in which the pines, Douglas-fir, and true firs each comprise 20 percent or more of the commercial conifer cover.

d. Fir. Areas with true firs comprising more than 80 percent of the commercial conifer cover; or mixtures of the true firs and mountain hemlock, or western white pine, in which the true firs comprise 20 percent or more of the commercial conifer cover.

e. Pine. Areas with ponderosa, Jeffrey, or sugar pine comprising more than 80 percent of the commercial conifer cover.

Other timber and vegetative types

a. Coniferous woodland. Areas with such trees as knobcone pine, western yew, California nutmeg, and scattered or scrub trees of commercial conifer species, covering more than 5 percent of the ground space and predominant over hardwoods that may partly compose the cover.

b. Hardwoods (woodland). Areas with hardwood trees (oaks, madrone, etc.), covering more than 50 percent of the ground except where in mixture with commercial conifers or herbaceous vegetation.

c. Woodland-grass. Areas with hardwood trees and herbaceous vegetation occurring in mixture--without commercial conifers--and the trees covering from 5 to 80 percent of the ground area and predominant over noncommercial conifers present in the cover.

d. Shrub and herb types consist of the following, where not in mixtures with noncommercial conifers or hardwoods:

1. Chaparral. Areas with such shrubs as manzanita, ceanothus, scrub oaks, etc., covering more than 50 percent of the ground.

2. Coastal sagebrush. Areas with such shrubs as California sagebrush, coyote brush, and wild buckwheats covering more than 50 percent of the ground.

3. Grass. Areas with grasses and associated herbaceous vegetation covering more than 50 percent of the ground except where the type qualifies as woodland-grass.

4. Marsh. Areas with the herbaceous vegetation characteristic of very poorly drained areas.

Nonvegetation types

a. Barren. Bare ground, rocky areas, river beds, mine dredgings, and talus essentially devoid of vegetation.

b. Cultivated, urban and industrial. Areas that are under cultivation or are used for residential or industrial purposes.

Age classes of commercial conifer stands on commercial forest land.

a. Old growth. Mature trees[13/] compose more than 80 percent of the conifer canopy.

b. Old growth--young growth. Mature trees compose from 50 to 80 percent of the conifer canopy.

c. Young growth--old growth. Mature trees compose 20 to 50 percent of the conifer canopy.

d. Young growth. Mature trees compose less than 20 percent of the conifer canopy.

1. Large young growth. More than 5 percent of the immature trees are larger than 11 inches d.b.h.

2. Small young growth. Ninety-five percent or more of the immature trees are less than 11 inches d.b.h.

Density classes of commercial conifer stands on commercial forest land.

a. Dense and semidense. Commercial conifers cover 50 percent or more of the ground space.

b. Open. Commercial conifers cover from 20 to 50 percent of the ground space.

c. Very open. Commercial conifers cover from 5 to 20 percent of the ground space.

d. Nonstocked. Commercial conifers cover less than 5 percent of the ground space.

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13/ All trees considered to have passed their optimum growth.

Stand-size classes. The national pattern established for the Forest Survey requires the classification of commercial forest land into the following stand-size classes.

a. Saw-timber stands. Stands having a minimum net volume per acre of 4,000 board feet, International 1/4-inch rule, in saw-timber trees (11.0 inches d.b.h. and larger for all species).

1. Old growth saw-timber stands. Saw-timber stands in which over 50 percent of the net board-foot volume is in old-growth saw-timber trees.

2. Young-growth saw-timber stands. Saw-timber stands in which 50 percent or more of the net board foot volume is in young-growth saw-timber trees.

b. Pole-timber stands. Stands failing to meet the saw-timber stand specifications, but at least 10 percent stocked with pole timber and larger trees and with at least half the minimum stocking in pole-timber trees (5.0 to 10.9 inches d.b.h.).

c. Seedling and sapling stands. Timber stands not qualifying as either saw-timber or pole-timber stands but having at least 10 percent stocking of trees and with at least half the minimum stocking in seedlings and saplings (0 to 4.9 inches d.b.h.).

d. Nonstocked areas. Areas of commercial forest land not qualifying as saw-timber, pole-timber, or seedling and sapling stands.

## Cull and defect

Cull factor. Amount of defect expressed as a percent of the gross volume of the tree or stand.

Cull trees. Live trees of saw-timber or pole-timber size that are unmerchantable for sawlogs now or prospectively because of defect or rot.

In commercial conifer species, a tree is considered a cull if less than 25 percent of the gross board foot scale is in merchantable material.

In hardwood species, a tree is considered cull if less than 40 percent of the gross scale in board feet is in merchantable material.

Trees that are culls on a board-foot basis are also considered culls on a cubic foot basis.

## Volume

Net volume. Gross wood volume less deduction for cull and breakage.

All-timber volume. Net volume in cubic feet of live and salvable dead saw-timber trees and pole-timber trees of commercial species, and cull trees of all species, from stump to a minimum 4.0-inch top inside bark. Includes bole only of softwoods but both bole and limbs of hardwoods to a minimum 4.0 inch diameter inside bark.

Live saw-timber volume. Net volume in board feet, International 1/4-inch rule, of live saw-timber trees.

a. Redwood trees. Volumes measured to an average utilized top with a minimum of 12.0 inches d.i.b.

b. All other trees. Volumes measured to an average utilized top with a minimum of 8.0 inches d.i.b.

Growing stock. Net volume in cubic feet of live saw-timber trees and live pole-timber trees from stump to a minimum 4.0-inch top (of central stem) inside bark.

Commercial species. Tree species considered in determining growing stock. Includes species on commercial forest land presently or prospectively usable for commercial timber products, such as minor conifers and hardwoods.

Sawlog portion. Net volume in cubic feet of saw-timber trees between stump and merchantable top.

Upper stem portion. Net volume in cubic feet of bole of saw-timber trees between merchantable top and a point on the bole with a minimum top 4.0 inches in diameter inside bark when it exists.

## Tree classes

Pole-timber trees. Trees 5.0 inches d.b.h. and larger of commercial species that do not meet specifications for saw-timber trees but do meet regional specifications of species, soundness, and freedom from defect.

Saw-timber trees. Trees of commercial species that contain at least one merchantable sawlog as defined by regional practice and which have a minimum diameter at breast height of 11.0 inches for all species.

Salvable dead trees. Merchantable dead standing trees not less than 30 inches d.b.h. and considered by the observer to be without evidence of defect and not excessively limby.

## Growth and mortality

Net annual growth. The change during a specified year in net volume of live saw timber or growing stock on commercial forest land resulting from natural causes exclusive of catastrophic losses.

Annual timber mortality. The net volume removed from live saw timber or growing stock on commercial forest land during a specified year through death from natural causes, but not as the result of catastrophes.

## Drain

Commodity drain. The volume of live saw timber or growing stock removed from commercial forest land during a specified year as timber products and logging waste.

Logging waste. The volume of live saw timber or growing stock cut or killed by logging on commercial forest land and not converted to timber products. Not all of this logging waste is of a size or quality, and in sufficient concentration to warrant utilization under present economic conditions.

Timber products output. The volume of timber products cut from both growing stock and other miscellaneous sources.

Timber products from miscellaneous sources. The volume of timber products cut from cull trees, limbs, dead trees, timber from noncommercial and nonforest land, and overutilization of growing stock.

## Tree species

Principal tree species found in the Redwood--Douglas-fir subregion include:

| | |
|---|---|
| Softwoods: | |
| Redwood | Sequoia sempervirens (D.Don) Endl. |
| Douglas-fir | Pseudotsuga taxifolia (Poir.) Britton |
| Ponderosa pine | Pinus ponderosa Laws. |
| Jeffrey pine | P. jeffreyi Grev. and Balf. |
| Sugar pine | P. lambertiana Dougl. |
| Western white pine | P. monticola Dougl. |
| California red fir | Abies magnifica A. Murr. |
| White fir | A. concolor (Gord. and Glend.) Hoopes |
| Grand fir | A. grandis (Dougl.) Lindl. |
| Incense cedar | Libocedrus decurrens Torr. |
| Port Orford white-cedar | Chamaecyparis lawsoniana (A. Murr.) Parl. |
| Sitka spruce | Picea sitchensis (Bong.) Carr. |
| Western hemlock | Tsuga heterophylla (Raf.) Sarg. |
| Mountain hemlock | Tsuga mertensiana (Bong.) Carr. |
| Western redcedar | Thuja plicata Donn |
| Hardwoods: | |
| California black oak | Quercus kelloggii Newb. |
| Canyon live oak | Q. chrysolepis Liebm. |
| Madrone | Arbutus menziesii Pursh |
| Tanoak | Lithocarpus densiflora (Hook. and Arn.) Rehd. |

## Ownership Classifications

National Forest. Federal lands which, by executive order or statute, have been designated as national forests, purchase units, or experimental areas or have been placed under the administration of the Forest Service.

Indian Land. Indian tribal lands and trust allotments. Lands held in trust by the Federal Government but administered and managed for Indian tribal groups, or allotted in trust to individual Indians.

Other Federal. All other lands owned by the Federal Government not classed as national forest or Indian land.

State forest. State lands which have been designated as state forests and are administered by the State Division of Forestry.

Tax deeded. Formerly privately owned land but now deeded to the State for nonpayment of taxes.

Other State, county, and municipal. Lands in State, county, or municipal ownership other than tax deeded or State forests.

Timber operating company. A corporation actively engaged in commercial logging and sawing of timber as a major enterprise.

Timber holding company. A corporation holding timber land principally for future commercial timber operations. The timber may be held for the company's own future use or for sale to other operators.

Timber operating individual. A person whose major enterprise is commercial timber operations. This includes individuals logging timber, operating a large or small sawmill, or splitting timber commercially for sale.

Timber holding individual. A person holding timber land principally for future commercial timber operations. The timber may be held for his own future operations or for sale to other operators.

Range livestock farming company. A corporation engaged primarily in range livestock farming operations.

Range livestock farming individual. A person whose major enterprise is range livestock farming.

Other farmers. Persons or corporations that have farming as their major activity, but whose principal agricultural enterprise is not range livestock farming.

Recreational property owners. Persons or corporations holding land principally for recreational purposes.

Other classified owners. All other land owners whose classification is known but does not logically fit the classes listed above. Examples are owners of land held for residential purposes only, for mining claims, and for reservoir sites.

Unclassified. Land ownership in urban, suburban, and industrial settlements that are too small to map and classify properly, and ownerships that for other reasons cannot be classified and placed in appropriate categories.

# FOREST SURVEY PUBLICATIONS SINCE 1949

| Forest Survey Release No. | Title | Date Issued |
|---|---|---|
| 7 | Cull Factors for Forest-Tree Species in Northwestern California | June 1, 1950 |
| 8 | Area and Ownership of Forest Land in Siskiyou County, California | Dec. 1950 |
| 9 | Area and Ownership of Forest Land in Trinity County, California | April 1951 |
| 10 | Area and Ownership of Forest Land in Mendocino County, California | Oct. 1951 |
| 11 | Area and Ownership of Forest Land in Lake County, California | Feb. 1952 |
| 12 | Forest Statistics for the Coast Range Pine Subregion in California | April 1952 |
| 13 | Cull and Breakage Factors and other Tree Measurement Tables for Redwood | May 1952 |
| 14 | Area and Ownership of Forest Land in Sonoma County, California | Sept. 1952 |
| 15 | Forest Products Used in Mines in California and Nevada, 1950 | Nov. 1952 |
| 16 | Area and Ownership of Forest Land in Humboldt County, California | Nov. 1952 |
| 17 | Lumber Production in California and Nevada-1951 | Dec. 1952 |

| Forest Research Note No. | Title | Date Issued |
|---|---|---|
| 66 | Board-Foot and Cubic-Foot Volume Tables for Second-Growth Redwood | Feb. 6, 1950 |
| 67 | Board-Foot and Cubic-Foot Volume Tables for some California Hardwoods | Feb. 23, 1950 |
| 79 | Production of Logs and Bolts for Plywood, Pulp, Container Veneer, Shingles, Cooperage, Poles, and Piling in California, 1950 | Nov. 1951 |

Agriculture--Berkeley